

MONTANA'S PULSE INDUSTRY

HOW IT HAS DEVELOPED, ECONOMIC IMPACT & POTENTIAL FOR GROWTH
(Abbreviated Version Without Appendices)

By:

Chad Lee

Montana Department of Agriculture

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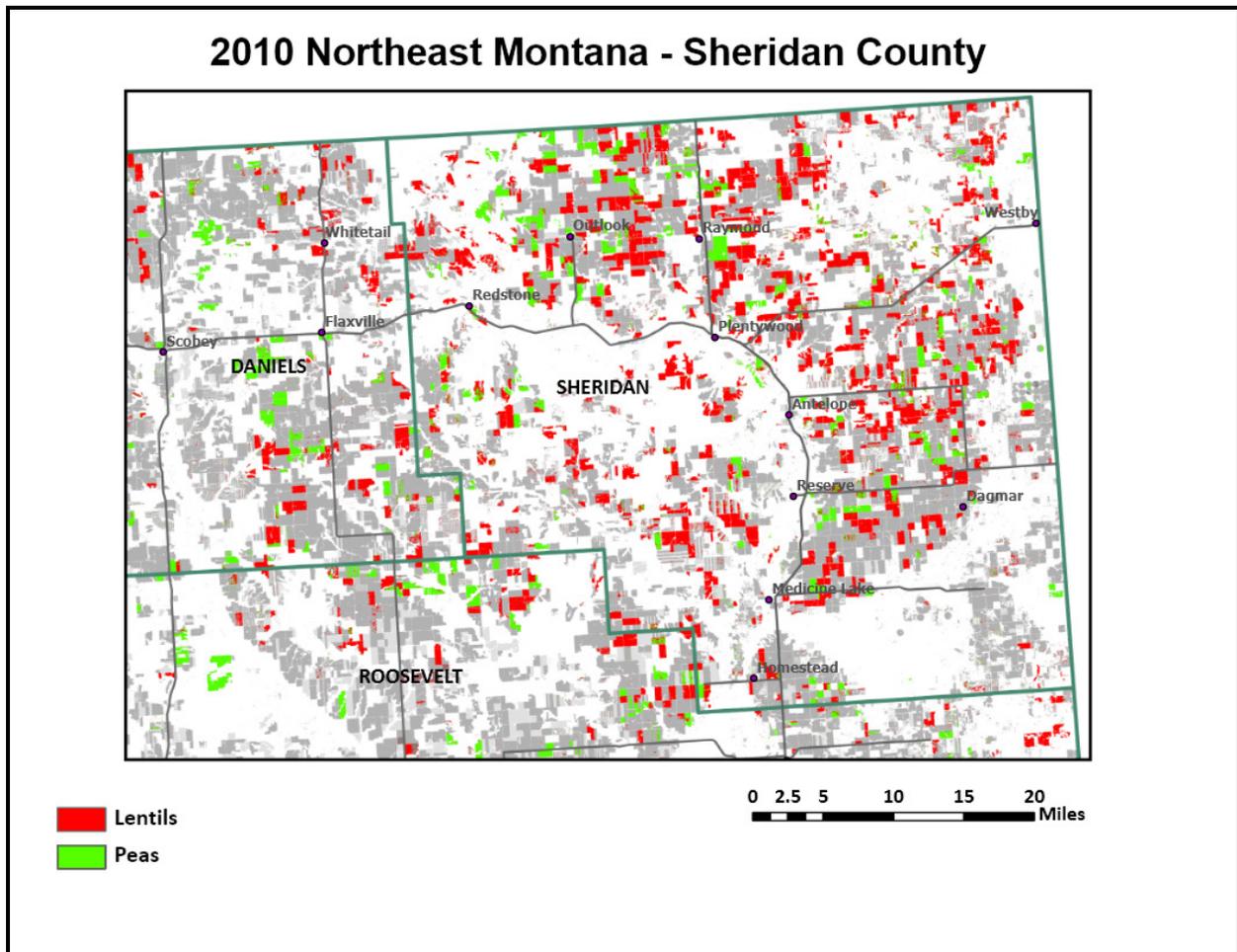


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EXECUTIVE SUMMARY

For over a decade, the production of pulse crops (peas, lentils, and chickpeas) has seen substantial growth in Montana. Looking ahead, Montana is poised to become a world-class pulse production region as acreages continue to expand and as Montana's reputation for quality becomes increasingly recognized across the globe.

Pea acres increased from 35,000 in 1998 to 227,000 acres in 2010. Lentil acres increased from 16,000 acres in 1998 to 255,000 acres in 2010. In recent years, there has been some substitution of lentil acres for pea acres attributable to lentil's high profit potential. In 2011, Montana took over the lead in lentil and pea production in United States, accounting for over half of all lentil acres and nearly half of all pea acres. Pulse production in Montana is not a fad. The current level of production and industry investment is firmly rooted, and there are fundamental reasons why significant future growth may occur.

Northeastern Montana is the leading pulse production region in Montana, accounting for 75 – 80% of the state's pulse crop acreage. The story from Northeastern Montana is not how much pulse production has increased there; rather, that the farmers of Northeastern Montana raise pulse crops on cropland that they previously left fallow for a growing season. Between 1998 and 2010, Northeastern Montana farmers increased pulse crop production by 341,000 acres while decreasing fallow by 390,000 acres. "Fallow" refers to cropland left idle for a year in non-irrigated (dryland) cropping systems.

Peas and lentils have shallow roots and are very efficient in their use of soil moisture. Peas and lentils also fix nitrogen in the soil and provide significant rotational benefits that help break crop disease cycles. These attributes allow farmers to adopt more intensive crop rotations that reduce or eliminate fallow, add more acres of cash crop production, and improve cereal grain yield and quality (higher protein, better test weights) in the crops that follow.

An estimate of the economic benefits attributable to the 2010 pulse crop in Northeastern Montana is \$102 million. This estimate represents the incremental increase of economic activity relative to what would have occurred if the land planted in pulse crops was left in fallow (*as was largely the case before 1998*). Of this, \$85 million is directly associated to the impact of pulse crops replacing fallow. The remaining \$17 million is an estimate of the economic benefit that the 2010 pulse crop will have on the following wheat crop in terms of increasing yield and improving wheat protein levels.

There is significant potential for increased pulse production throughout Montana. If only 12.5% of Montana's 3.46 million acres of fallow was replaced with pulse crops, production would increase by over 430,000 acres, resulting in a near-doubling of Montana's record 2010 pulse crop. Within the next five to fifteen years, Montana's dryland pulse crop acreage could increase by 500,000 to 1,250,000 acres, without significantly changing wheat acreages. In situations where fallow is not replaced by pulse crops, pulse crops could displace some acreage of cereal grain crops. Increased pulse production may also occur on irrigated cropland, possibly in excess of 50,000 acres. Increased irrigated pulse production may play a critical role in encouraging the development of additional pulse processing facilities.

The economic benefits of expanded pulse production in Montana are substantial. Even a modest level of replacement of fallow by pulse crops would generate an economic benefit similar to what has been realized in Northeastern Montana. An illustration discussed in this paper shows that replacement of approximately 25% of Montana's fallow cropland with pulse crops could generate an annual economic benefit of about \$243 million (*based on recent market conditions*). Of this, approximately \$207 million

would be attributed to the replacement of fallow with pulse crops and \$36 million would be attributed to benefits affecting the following wheat crop.

The economic benefits that may be realized if pulse crops replace dryland cereal grain acreage are more modest in comparison to pulse crops replacing fallow. The reason for this is that the change in economic activity and profits is incrementally smaller and the acreage involved would likely be less. Similarly, the economic benefits of increased irrigated pulse production are also modest in comparison. Irrigated cropland is already continuously cropped; so there is no fallow to displace. The acreage of irrigated cropland in Montana is also much smaller than dry cropland. However, the potential economic benefit of increased irrigated pulse production is significant, and increased irrigated pulse production may provide environmental services to society through decreased irrigation water withdrawal.

Pulse processing facilities help strengthen the market for pulse crops and contribute to Montana's economy. Pulse processing is often limited to cleaning and bagging, but also can include decorticating (taking the outer skin off), splitting, and pulse flour milling. Financial information is closely held by pulse processing companies, so only estimates can be made about the value added to pulse crops by facilities located in the state. An estimate explained in this paper discusses how pulse processing in Montana may have added as much as \$15 million in value to the 2010 pulse crop. Value added is allocated to wages, operating costs, capital investment recovery, taxes, shipping costs, and profits. As of December 2011, Montana had three large pulse processing plants, located in Plentywood, Chinook, and Hingham. The capital investment in these facilities may exceed \$10 million. The capacity of the existing processing facilities is not known, but it is reasonable to assume that each processing facility has the capacity to process 20,000 – 75,000 acres of pulse crops. Additional investment is scheduled for the facility located in Chinook. A processing facility is slated to be constructed in the near future at Tiber (west of Chester). Several companies are actively seeking to identify and secure sites for processing facilities in Montana or are evaluating future investments.

There are a number of factors driving expansion of the pulse industry. Global demand is being driven by population growth and economic gains in other parts of the world, particularly in India where dietary protein needs are not being met by domestic production and imports. Additionally, peas and lentils serve as less expensive substitutes for other pulses and beans grown in south Asia. Exports from the United States are not limited to south Asia and China; significant volumes are exported to countries in Europe, South America, Latin America, Africa, and the Middle East. In recent years, the world pulse supply has been tight because of demand factors, weather events, and loss of acres to other crops. This has encouraged the pulse industry and major importing countries to look for new sources of supply. The decline of the U.S. dollar has been useful in putting the U.S. in a better competitive position relative to major exporting countries like Canada and Australia. Efforts made in research and product development are close to paying off in creating substantial new demand for pulses in the United States and developed countries. Pulse crops have very favorable nutritional attributes that can address health issues such as heart disease, diabetes, weight control, digestive tract health, some types of cancer, food allergies, and pre-natal health. Pulses can be fractionated into highly functional components (protein, fiber, and starch) utilized as ingredients to enhance processed foods. Products made from pulse crops will have added market appeal in the developed world because they are economically, environmentally, and socially sustainable.

Clearly, Montana’s economy, farmers, and communities have a lot to gain from expanded pulse production; there may be no single opportunity available to Montana’s agricultural industry that offers as much potential benefit. It may be beneficial for Montana stakeholders and policy makers to review, consider, and prioritize actions that will assist Montana’s pulse industry reach its potential and do so in an expedited timeframe. Montana commodity check-off funds for pulses and cereal grains can be focused to address the opportunity to advance Montana cropping systems to replace fallow with pulse crops and utilize pulse crops to enhance cereal grain yields and quality. Escalating many facets of research impacting the pulse industry may yield a disproportionate level of benefit. Efforts to improve market reporting and dissemination of industry information would improve market transparency and could reduce the hesitation of farmers starting to raise pulse crops or expanding production. Additional efforts could further substantiate Montana’s reputation for high quality pulse crops and promote Montana as a premier origination point. Public-private partnerships and cooperation amongst pulse shippers may help address pulse shippers’ rail shipping challenges. Actions that would encourage further development of pulse processing and milling in Montana will not only generate economic activity and create jobs, but will provide for greater resiliency for volatility in prices and variability in crop quality. Montana’s pulse industry and policy makers can evaluate their level of engagement in federal policy development, which can influence the advancement of the United States pulse industry in numerous ways, such as research, crop insurance, conservation programs, school nutrition, and free trade agreements.

1.0 PULSE & FALLOW ACREAGE STATISTICS

Crop acreage data from 1998 through 2011 collected by the USDA Farm Service Agency (USDA-FSA) was used to develop the information presented here. USDA-FSA collects crop acreage data during its annual farm program sign-up process. This section also discusses the March 2011 USDA Prospective Plantings Report and July 2011 USDA Crop Production Report.

Montana's major pulse crop production region is Northeastern Montana. In the past decade, Northeastern Montana has accounted for roughly 80% of Montana's pulse crop acreages. In 2010, Northeastern Montana's share dropped to 75%. In 2011, it was 65%. Despite the likelihood that pulse acres will continue to increase in Northeastern Montana, its *share* of total pulse acreage in Montana will likely decline as pulse acreage growth accelerates elsewhere in the state, particularly in the Golden Triangle (*the region in north central Montana defined by an imaginary line between Great Falls, Havre, and Cut Bank that includes Cascade, Chouteau, Glacier, Hill, Pondera, Teton, and Toole counties*).

1.1 ACREAGE STATISTICS HIGHLIGHTS

Peas

Statewide, peas raised for grain increased from 35,000 acres in 1998 to 175,000 acres in 2011. Montana's record year for pea acreage occurred in 2007 with 254,000 acres.

The March 2011 USDA Prospective Plantings Report estimated that Montana farmers would plant 215,000 acres in 2011. In 2010, Montana farmers planted 227,000 acres of peas. The reduction of peas acres reflected in the 2011 planting intentions is likely the result of farmers choosing to grow lentils instead of peas.

The July 2011 USDA Crop Production Report estimated 2011 Montana pea production at 190,000 acres, a downward adjustment from the Prospective Planting Report attributed to difficult seeding conditions.

The 2011 USDA-FSA reported acreage shows farmers growing 175,000 acres of peas for grain. Farmers reported to USDA-FSA that they were prevented from planting 20,600 acres of peas (due to difficult seeding conditions).

Lentils

Statewide, lentils raised for grain increased from 16,000 acres in 1998 to 253,000 acres in 2011. 2011 production was down 2,000 acres from 2010's record crop. 2010 was an explosive year for lentil production in Montana, considering that the previous record acreage was in 2005 at 146,000 acres.

The March USDA Prospective Plantings Report estimated that Montana farmers would plant 320,000 acres in 2011. Had the forecast come to fruition, it would have been the second consecutive year for record-breaking plantings.

The July 2011 USDA Crop Production Report estimated 2011 Montana lentil production at 280,000 acres, a downward adjustment from the Prospective Planting Report attributed to difficult seeding conditions.

The 2011 USDA-FSA reported acreage shows farmers growing 253,000 acres of lentils for grain. Farmers reported to USDA-FSA that they were prevented from planting 30,500 acres of lentils (due to difficult seeding conditions).

Chickpeas

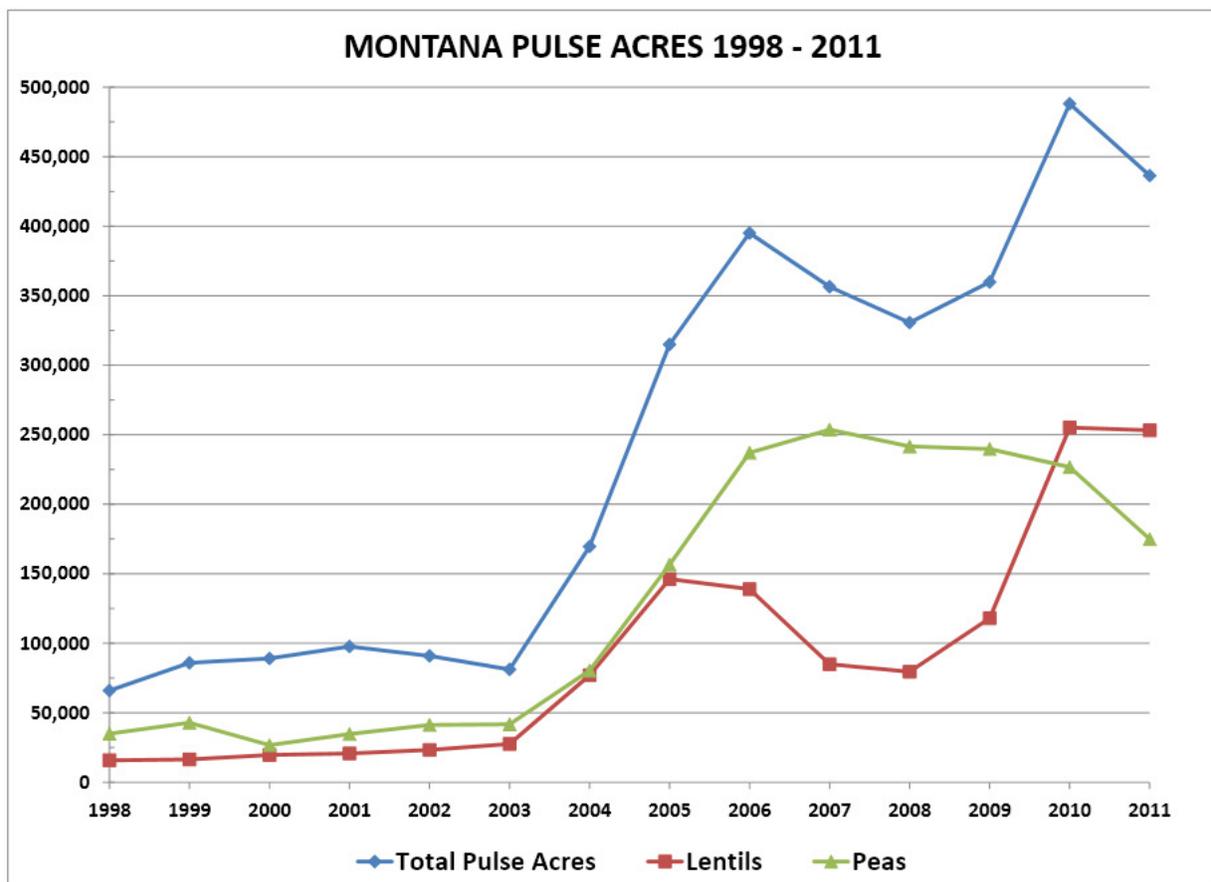
The 2011 USDA-FSA reported acreage shows farmers growing 8,300 acres of chickpeas for grain. Farmers reported to USDA-FSA that they were prevented from planting 800 acres of chickpeas (due to difficult seeding conditions).

The March USDA Prospective Plantings Report estimated that Montana farmers would plant 18,000 acres in 2011. No estimate of chickpea acres was provided in the July 2011 USDA Crop Production Report.

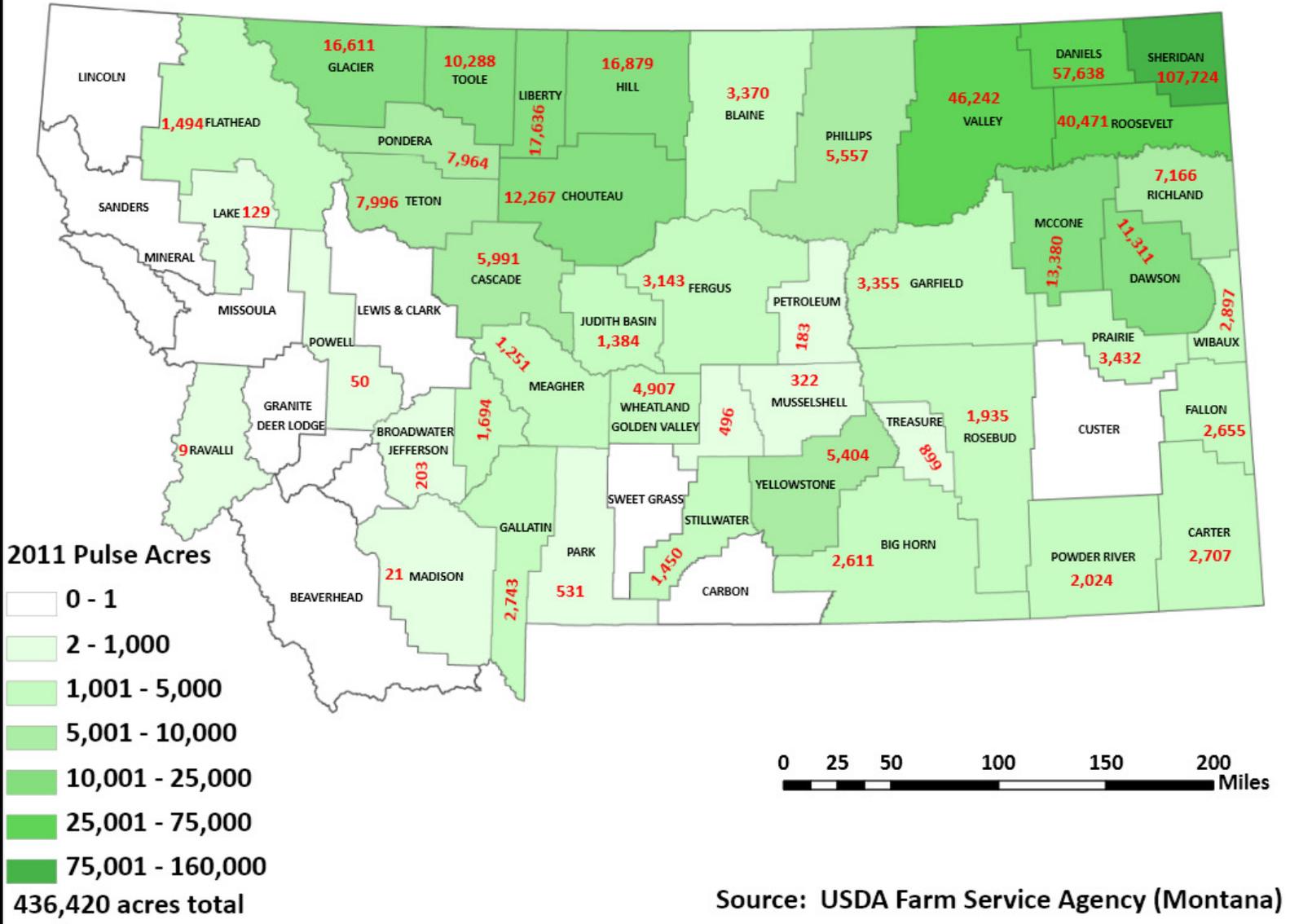
It is very difficult to establish a good estimate of chickpea acreages prior to 2009, because data released from USDA-FSA blended chickpeas acres with dry bean acres. In 1998, there were roughly 15,000 acres of dry beans and chickpeas. Most likely 11,000 acres of these were dry beans, leaving approximately 4,000 acres of chickpeas. In 2011, there were roughly 8,300 acres of chickpeas raised for grain. Chickpea production peaked in Montana in 2000 and 2001, with an estimated 23,000 acres and 27,000 acres, respectively.

1.2 RECENT JUMPS IN PULSE CROP ACREAGE

In 2010, Montana pulse crop acres increased 36% to 488,000 acres (from 360,000 acres in 2009). Were it not for 2011's difficult seeding conditions, 2011 pulse crop production would have tied 2010's record acreage. Notably, the Golden Triangle region has increased its pulse acres significantly two years in a row, from 27,000 acres in 2009 to 66,000 acres in 2010 to nearly 96,000 acres in 2011. Noticeable increases in pulse production occurred in 2011 in South Central Montana (in Big Horn, Wheatland, and Yellowstone counties) and in Southwestern Montana (in Gallatin and Broadwater counties).



2011 Montana Pulse Crop Acreage



1.3 RELATIONSHIP BETWEEN INCREASED PULSE CROP ACREAGE AND DECREASED FALLOW CROPLAND IN NORTHEASTERN MONTANA

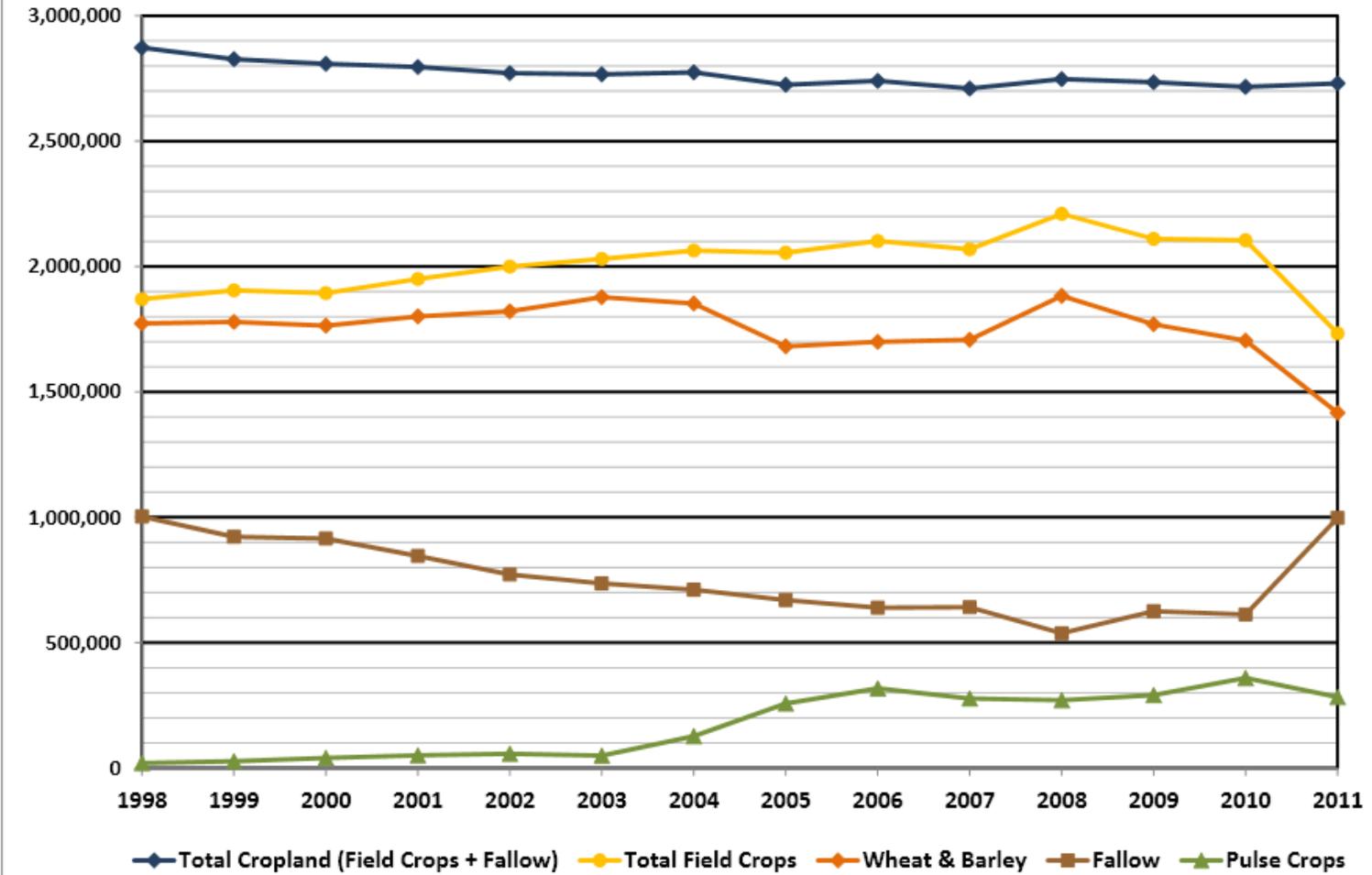
“Fallow” refers to cropland left idle for a year in non-irrigated (dryland) cropping systems. Farmers fallow cropland primarily to store precipitation for the following crop. Between 1998 and 2010, farmers in Northeastern Montana decreased fallow by 390,000 acres. During this time, the percentage of non-irrigated cropland left in fallow decreased from 35% to 23% (*a 34% reduction in fallow*). This essentially means that, on average, farmers in the region went from fallowing once every three years to fallowing once every four years. In actuality, some farmers may have eliminated fallow altogether, while others did not change cropping practices.

Major pulse counties reduced fallow the most. The top two pulse counties have almost eliminated fallow. Sheridan County, (the #1 pulse producing county in Montana) reduced its fallow from 32% in 1998 to 6% in 2010. Daniels County (the #2 pulse producing county) reduced its fallow from 30% to 12%. Two other significant pulse counties, Valley County (#3) and Roosevelt County (#4), reduced fallow from 37% to 27%. During this time period, farmers in northwestern North Dakota also made substantial reductions in fallow acreage.

While the region’s fallow acreage decreased by 390,000 acres, pulse crop acreage increased by 341,000 acres. The increase in pulse crop acreage explains the majority of the change in land use. Even though the total acreage of dry cropland involved in field crop production (*which excludes land planted in forage crops and pasture*) decreased by 156,000 acres, the total acreage planted in field crops increased by 234,000 acres, mostly because of increased pulse crop production. Dryland wheat and barley production decreased by approximately 68,000 acres, with barley accounting for most of the decrease. Since the addition of pulse acres was less than the decrease in fallow acres, it would be reasonable to assume that pulse crops were not responsible for the decrease in wheat and barley acreage. The reduction of wheat and barley acres is best accounted for by the decrease in cropland involved in field crop production and slight increase in land enrolled in USDA’s Conservation Reserve Program.

In 2011, fallow acres increased because difficult seeding conditions prevented farmers in Northeastern Montana from planting nearly 550,000 acres of dry cropland.

NORTHEASTERN MONTANA DRYLAND CROP STATISTICS 1998 - 2011 (acres)



Source: USDA Farm Service Agency (Montana)

2.0 ECONOMIC IMPACT OF PULSE CROPS REPLACING FALLOW IN NORTHEASTERN MONTANA

The economic impact in Northeastern Montana of replacing fallow with pulse crops is dramatic. Farmers began this process in the mid to late 1990's and are still continuing to replace additional fallow acreage with pulse crops.

An estimate developed using a simple methodology indicates that Northeastern Montana's 2010 pulse crop generated \$102 million of economic benefits. Of this amount, \$85 million is directly associated to pulse crops replacing fallow. The economic benefits to the following wheat crop (*attributable to the 2010 pulse crop*) are estimated to be \$17 million, for higher yields and higher protein levels.

The \$102 million estimate represents the *incremental increase of economic activity relative to what would have occurred if the land planted in pulse crops in 2010 was left in fallow, as was the case over a decade ago.* These estimates are not factored by economic multipliers that attempt to quantify the ripple effect (churning) of the economic benefits to the region. Such a multiplier would likely be less than 2, and possibly be less than 1.5.

The increase in farm profits in Northeastern Montana attributable to the 2010 pulse crop may exceed \$61 million (\$44 million directly attributable to the pulse crops replacing fallow and \$17 million related to economic benefits of 2010 pulse crop production on the following wheat crop). It is estimated that in 2010, pea production increased profits by approximately \$58/acre compared to leaving cropland fallow. It is estimated that in 2010, lentil and chickpea production increased profits by approximately \$168/acre compared to leaving cropland fallow. Based on estimated rotation benefits and recent market conditions, the 2010 pulse crop may improve the profitability of the following spring wheat crop by \$48/acre (*through improvements in yield and grain protein content*).

The distinction between "economic benefits" and "improved farm profits" is that "economic benefits" is a measure in the change of total economic activity. "Improved farm profits" is the net economic benefit realized by growers. The difference between the two economic measures is likely realized by agribusinesses serving farmers. The additional farm profits are likely to be utilized in a variety of ways, including capital expenditures on farm equipment and facilities, accelerated debt repayment, savings, improved lifestyles for farm owners, and additional compensation for labor, whether it be higher wages, more hours, or more employees.

It is important to point out that "economic benefit" discussed in this section ignores the additional economic impact resulting from the growth of the pulse industry that relates to grain handling, processing, and shipping that transpire after growers sell their crop. These impacts occur in northeastern Montana, northwestern North Dakota, and outside the region.

The magnitude of the estimated economic benefits and increased farm profits discussed here is impacted by strong pulse crop prices received in the 2010 marketing year, high wheat prices (spring and summer 2011), and high price differentials for protein (spring and summer 2011). Even in more "normal" times, the economic impact would be large. However, in more normal times, farm profitability would be lower, *making the improvements in farm profitability attributable to pulse production even more important.*

3.0 POTENTIAL FOR INCREASED PULSE ACREAGE IN MONTANA DRYLAND CROPPING SYSTEMS

The USA Dry Pea & Lentil Council projects pulse crop acreage in the United States will double from 1.5 million acres in 2009 to 3 million acres in 2015, with a large amount of the increase occurring in Montana.

Within the next five to fifteen years, Montana’s dryland pulse crop acreage could increase by 500,000 – 1.25 million acres, to a total of 1 – 1.75 million acres of pulse crops. If this occurs, Montana may lead the United States in pulse crop production and rank globally with major pulse exporting countries. Canada (led by Saskatchewan) will remain the dominant global exporter of pulse crops. There still is potential to increase pulse acres in the western half of North Dakota (*which was the leading pulse production state in the United States until difficult seeding conditions in 2011 led Montana to surpass it*). However, competition for acreage from other crops (corn, soybeans, canola), may displace pulse acreage elsewhere in North Dakota.

In Montana, the largest portion of the additional acres will likely result from raising pulse crops on non-irrigated cropland that otherwise would have been left fallow. The degree of replacement of fallow will vary between regions and microclimates, mostly as a function of quantity and timing of rainfall. Actual fallow replacement will be impacted by farmers’ observations or perceptions of whether rotational benefits from pulse crops outweigh yield reductions that may result from reduced soil moisture attributable to more intense cropping. Many areas of the state receive less precipitation than Northeastern Montana and may receive it at different times. Because of this, the level of replacement of fallow with pulse crops in many areas of Montana may not be as high as has already occurred in Northeastern Montana. Prior herbicide selection and use will also impact the rate of expansion of pulse crops since certain herbicides that would kill or damage pulse crops may persist in the soil several years.

The table below lists total fallow acreages for different agricultural regions in Montana. The table also illustrates the potential replacement of fallow acres by pulse crops that the author believes might occur in the next five to fifteen years. Columns showing various percentages of fallow acres are provided to help the reader get a sense of the acreage of fallow that might be replaced with pulse crops.

Montana Fallow Acres – Potential for Increased Pulse Crop Production

Region	Fallow Acres (2007 – 2010 average)	50% of Fallow (Acres)	25% of Fallow (Acres)	12.5% of Fallow (Acres)	Illustrated Fallow Replacement (Acres / % of 2007-2010 Average Fallow Acres)
Golden Triangle	1,828,000	914,000	457,000	228,500	485,500 / 26.55%
Northeast	604,000	302,000	151,000	75,500	178,000 / 29.47%
Blaine/Phillips	299,000	149,500	74,750	37,375	70,700 / 23.68%
Fergus / Judith Basin	145,000	72,500	36,250	18,125	47,500 / 32.70%
Upper Yellowstone	221,000	110,500	55,250	27,625	40,900 / 18.54%
Other Counties	367,000	183,500	91,750	45,875	55,900 / 15.23%
Total	3,464,000	1,732,000	866,000	433,000	878,500 / 25.36%

Northeastern Montana Counties: Daniels, Dawson, McCone, Richland, Roosevelt, Sheridan, Valley

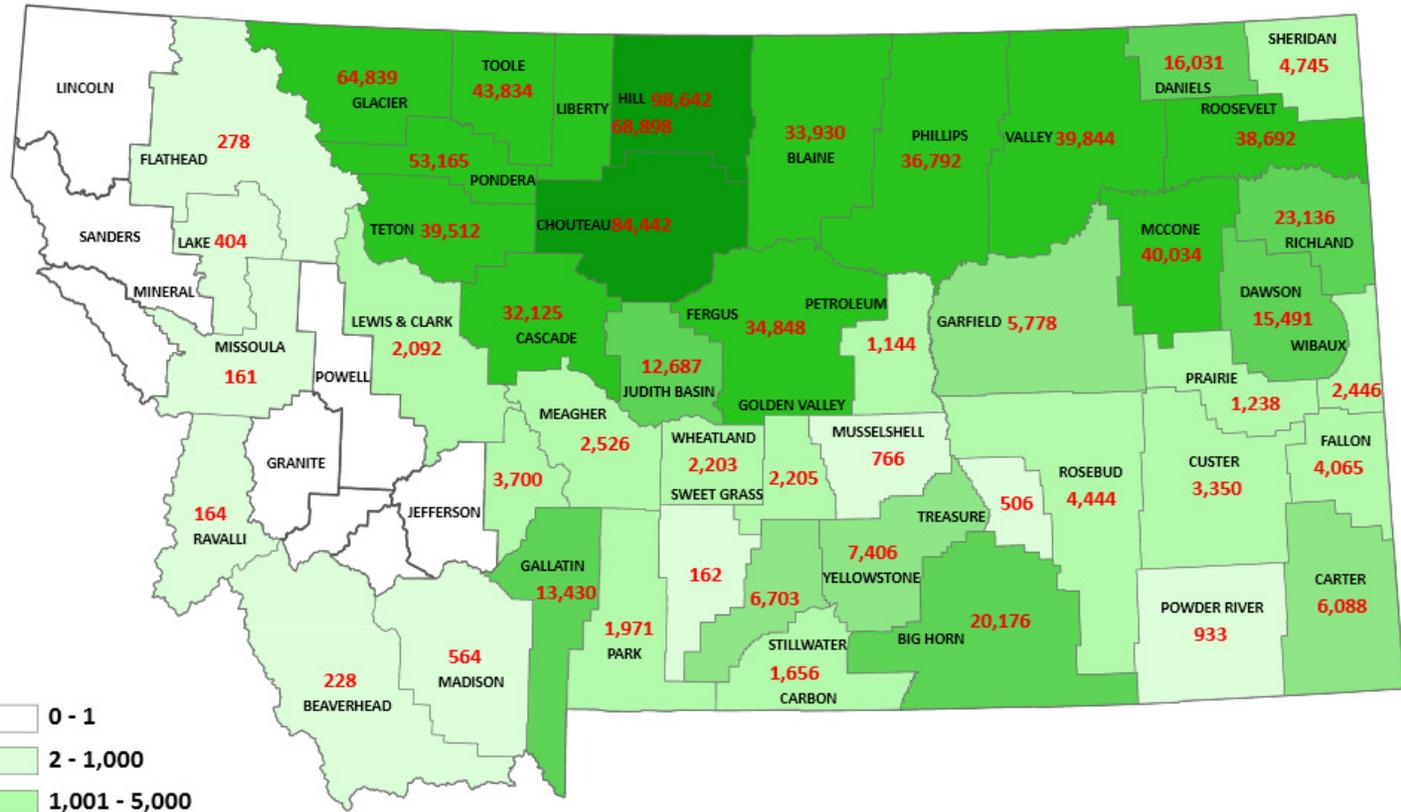
Golden Triangle Counties: Cascade, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, Toole

Upper Yellowstone Counties: Bighorn, Carbon, Rosebud, Stillwater, Treasure, Yellowstone

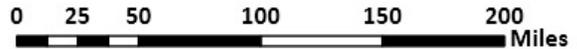
The “illustrated fallow replacement” ignores the potential increase in pulse acres that may occur when some of Montana’s 3 million acres of idled cropland enrolled in the USDA Conservation Reserve Program (CRP) are put back into production. It is not anticipated that more than 35% of the land currently in CRP

to be returned to crop production. Of the amount returned to crop production, it is anticipated that no more than 12.5% - 25% would be used to raise pulse crops (131,000 - 263,000 acres).

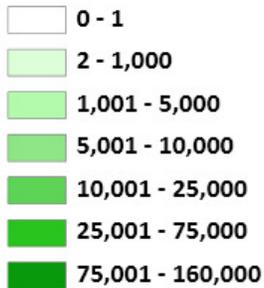
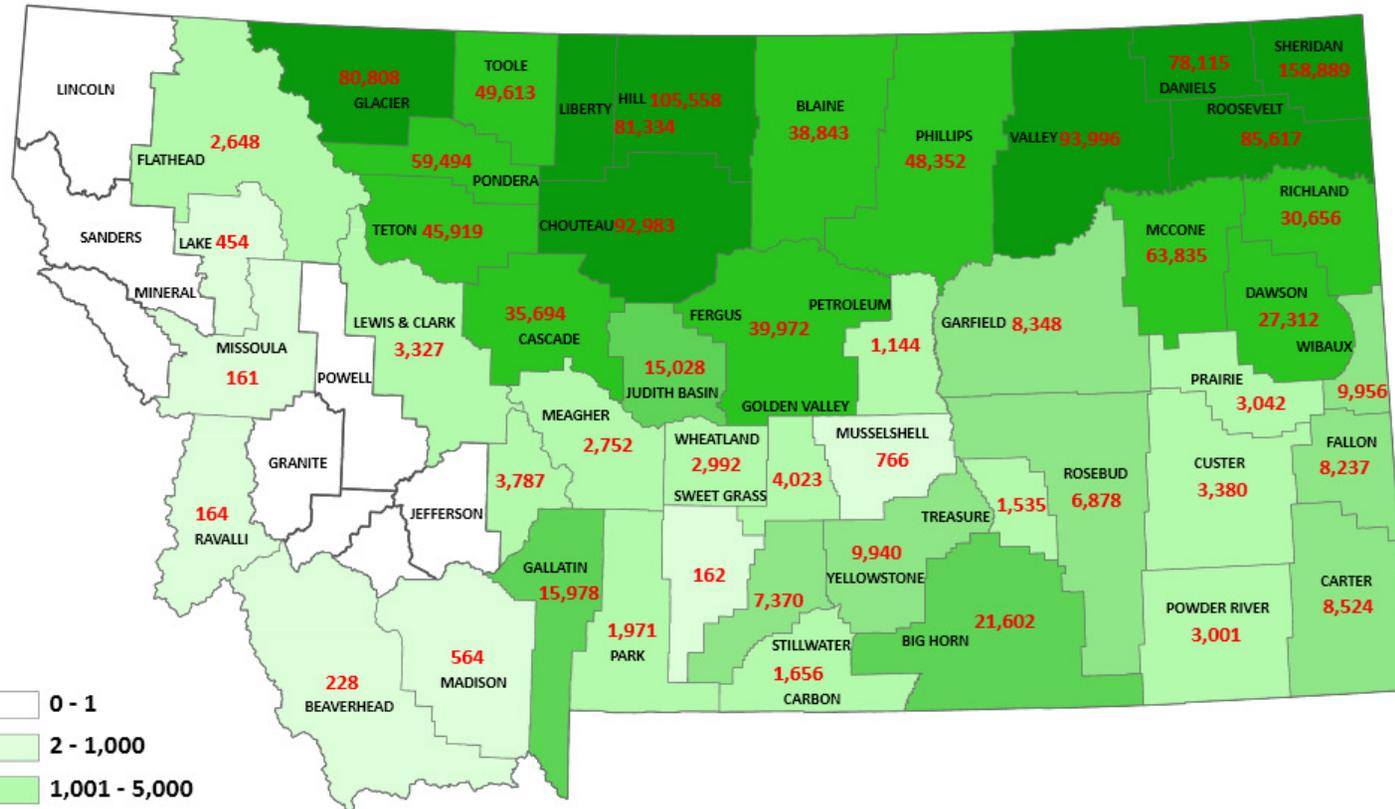
Potential Replacement of Fallow with Pulse Crops (5 - 15 Years)



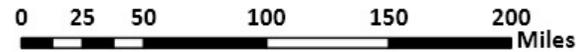
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 - 2 - 1,000
 - 1,001 - 5,000
 - 5,001 - 10,000
 - 10,001 - 25,000
 - 25,001 - 75,000
 - 75,001 - 160,000
- 878,475 acres Total**



Potential Pulse Crop Acreage (5 - 15 Years)



1,366,605 acres Total



ILLUSTRATED REPLACEMENT OF FALLOW BY PULSE CROPS (in the next 5 – 15 years)

	Fallow: 2007-2010 Average (acres)	Estimated Replacement of Fallow by Pulse Crops (%)	Estimated Replacement of Fallow by Pulse Crops (acres)	% of Dry Cropland in Fallow (before Replacement)	% of Dry Cropland in Fallow (after Replacement)	2010 Dryland Pulse Acres	Projected Dryland Pulse Acres (excluding dryland pulse acres, where pulse crops replace other crops)
Cascade	102,801	31.25%	32,125	39.64%	27.25%	3,491	35,616
Chouteau	450,360	18.75%	84,442	45.04%	36.59%	8,676	93,118
Glacier	129,677	50.00%	64,839	36.43%	18.21%	12,421	77,260
Hill	394,568	25.00%	98,642	47.53%	35.64%	6,743	105,385
Liberty	220,475	31.25%	68,898	43.59%	29.97%	12,158	81,056
Pondera	170,127	31.25%	53,165	43.29%	29.76%	4,620	57,785
Teton	126,438	31.25%	39,512	42.22%	29.02%	5,395	44,907
Toole	233,779	18.75%	43,834	45.08%	36.63%	5,779	49,612
Golden Triangle	1,828,225	26.55%	485,457	43.92%	32.26%	59,283	544,740
Daniels	51,300	31.25%	16,031	13.04%	8.97%	61,941	77,972
Dawson	82,619	18.75%	15,491	30.96%	25.16%	11,761	27,252
McCone	106,756	37.50%	40,034	30.82%	19.26%	23,728	63,761
Richland	74,035	31.25%	23,136	28.19%	19.38%	7,352	30,487
Roosevelt	123,813	31.25%	38,692	25.01%	17.19%	46,902	85,593
Sheridan	37,958	12.50%	4,745	8.12%	7.11%	153,307	158,052
Valley	127,501	31.25%	39,844	25.72%	17.68%	53,985	93,829
Northeast MT	603,982	29.47%	177,972	22.14%	15.62%	358,975	536,947
Blaine	180,962	18.75%	33,930	47.57%	38.65%	4,841	38,771
Phillips	117,735	31.25%	36,792	44.87%	30.85%	11,322	48,114
Blaine-Phillips	298,698	23.68%	70,723	46.47%	35.46%	16,163	86,886
Fergus	111,513	31.25%	34,848	35.01%	24.07%	5,124	39,972
Judith Basin	33,831	37.50%	12,687	26.20%	16.37%	2,341	15,028
Central MT	145,344	32.70%	47,534	32.47%	21.85%	7,466	55,000
Big Horn	80,703	25.00%	20,176	40.81%	30.61%	1,426	21,602
Carbon	6,622	25.00%	1,656	46.02%	34.51%	0	1,656
Rosebud	35,555	12.50%	4,444	43.98%	38.49%	2,426	6,870
Stillwater	35,752	18.75%	6,703	43.58%	35.41%	715	7,418
Treasure	2,699	18.75%	506	40.75%	33.11%	1,029	1,535
Yellowstone	59,252	12.50%	7,406	38.40%	33.60%	2,534	9,940
Upper Yellowstone	220,582	18.54%	40,892	41.16%	33.53%	8,129	49,020
Custer	26,800	12.50%	3,350	51.79%	45.31%	30	3,380
Prairie	19,814	6.25%	1,238	35.87%	33.62%	1,635	2,873
Carter	24,354	25.00%	6,088	35.63%	26.72%	2,436	8,524
Fallon	21,682	18.75%	4,065	30.16%	24.50%	4,172	8,238
Powder River	14,925	6.25%	933	55.20%	51.75%	2,068	3,001
Wibaux	13,043	18.75%	2,446	20.67%	16.80%	7,510	9,955
Garfield	92,451	6.25%	5,778	48.21%	45.19%	2,570	8,348
Musselshell	12,249	6.25%	766	26.90%	25.22%	0	766
Petroleum	18,296	6.25%	1,144	48.26%	45.24%	0	1,144
Golden Valley	17,642	12.50%	2,205	37.80%	33.08%	1,818	4,023
Meagher	8,085	31.25%	2,526	38.16%	26.23%	83	2,610
Park	6,307	31.25%	1,971	43.98%	30.23%	0	1,971
Sweet Grass	862	18.75%	162	28.88%	23.46%	0	162
Wheatland	17,625	12.50%	2,203	28.43%	24.88%	777	2,980
Beaverhead	609	37.50%	228	57.44%	35.90%	0	228
Broadwater	14,800	25.00%	3,700	38.33%	28.75%	54	3,754
Gallatin	35,814	37.50%	13,430	41.78%	26.11%	823	14,253
Jefferson	241	0.00%	0	42.18%	42.18%	0	0
Lewis & Clark	8,367	25.00%	2,092	35.17%	26.38%	792	2,884
Madison	2,257	25.00%	564	36.91%	27.68%	0	564
Deer Lodge	141	0.00%	0	97.65%	97.65%	0	0
Flathead	4,455	6.25%	278	19.96%	18.71%	1,640	1,919
Granite	16	0.00%	0	100.00%	100.00%	0	0
Lake	3,230	12.50%	404	44.47%	38.91%	0	404
Lincoln	0	0.00%	0	0.00%	0.00%	0	0
Mineral	160	0.00%	0	36.53%	36.53%	0	0
Missoula	1,285	12.50%	161	69.49%	60.80%	0	161
Powell	132	0.00%	0	35.54%	35.54%	0	0
Ravalli	658	25.00%	164	43.98%	32.99%	0	164
Sanders	788	0.00%	0	59.43%	59.43%	0	0
Silver Bow	0	0.00%	0	0.00%	0.00%	0	0
Other Counties	367,048	15.23%	55,897	38.60%	32.73%	26,408	82,305
State Total	3,463,878	25.36%	878,475	36.59%	27.31%	476,422	1,354,897

4.0 ILLUSTRATION OF POTENTIAL STATEWIDE ECONOMIC BENEFITS FROM REPLACEMENT OF FALLOW WITH PULSE CROPS IN DRYLAND CROPPING SYSTEMS

Using economic assumptions based on recent (2010 marketing year) conditions, the potential annual economic benefit of replacing fallow cropland in Montana with pulse crops is in the neighborhood of \$243 million, if it occurs as illustrated here. Of this amount, \$207 million is attributable to the replacement of fallow with pulse crops and \$36 million is from benefits to the following wheat crop attributable to the pulse crop.

The methodology used to come to this estimate is similar to the method used to calculate the economic benefit of Northeastern Montana’s 2010 pulse crop, discussed in Section 2. The conversion of fallow to pulse crop acreage is based on the illustration shown in Section 3. The estimate was made with the assumption that 2010 pulse crop economics and 2011 wheat price information are applicable in the future. The assumptions for the economic benefit of pulse crops to the following wheat crop are adjusted by region to reflect 2011 winter wheat and spring wheat market conditions and rotation benefits for wheat (*5 bushels/acre yield improvement for winter wheat, 3 bushels/acre yield improvement for spring wheat, 0.25% higher protein content for winter wheat, and 0.5% higher protein content for spring wheat*).

In developing this illustration, the projected replacement of fallow might be achieved in the next five to fifteen years. No assurances are provided about the assumptions used, whether similar market conditions will persist into the future, or about the likelihood of the illustrated fallow replacement.

Estimate of Potential Annual Economic Benefits of Additional Replacement of Fallow with Pulse Crops in Montana

Region	Illustrated Conversion of Fallow (Additional Pulse Crop Acres / % of 2007-2010 Average Fallow Acres)	Economic Benefit from Replacement of Fallow (using 2010 crop information)	Economic Benefit to Following Wheat Crop (using 2010 crop information)	Total Estimated Annual Economic Benefit (using 2010 crop information)
Golden Triangle	485,500 / 26.55%	\$114.5 million	\$18.6 million	\$133.0 million
Northeast	178,000 / 29.47%	\$42.0 million	\$8.5 million	\$50.5 million
Blaine/Phillips	70,700 / 23.68%	\$16.7 million	\$3.4 million	\$20.1 million
Fergus / Judith Basin	47,500 / 32.70%	\$11.2 million	\$1.8 million	\$13.0 million
Upper Yellowstone	40,900 / 18.54%	\$9.6 million	\$1.6 million	\$11.2 million
Other Counties	55,900 / 15.23%	\$13.2 million	\$2.1 million	\$15.3 million
Total	878,500 / 25.36%	\$207.2 million	\$36.0 million	\$243.1 million

Northeastern Montana Counties: Daniels, Dawson, McCone, Richland, Roosevelt, Sheridan, Valley

Golden Triangle Counties: Cascade, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, Toole

Upper Yellowstone Counties: Bighorn, Carbon, Rosebud, Stillwater, Treasure, Yellowstone

The magnitude of these estimates is impacted by good pulse crop prices received in the 2010 marketing year, high wheat prices (spring and summer 2011), and high price differentials for protein (spring and summer 2011).

5.0 POTENTIAL FOR INCREASED IRRIGATED PULSE PRODUCTION

There is potential for a meaningful increase in irrigated pulse production. The table below illustrates a simplified estimate for potential irrigated pulse acreage in Montana (excluding dry beans). The author believes that statewide irrigated pulse production (in addition to dry bean production) of 37,000 acres might be achieved in the next five to fifteen years.

The estimates in this illustration assume that not all irrigated farm operations will incorporate pulse crops into their rotations. Ultimately acreages could be higher (*particularly if irrigated pulse production took off in the Golden Triangle, Southwestern Montana, and in the Upper Yellowstone Region*) possibly allowing for as much as 90,000 acres of irrigated pulse production statewide. It is known that farmers have had success with irrigated pulse crops in the Golden Triangle, Gallatin County, and Flathead County. More analysis needs to be done to get a better understanding of the suitability of irrigated pulse production in various areas of the state with regard to soil types, climatology, agronomics, and comparative economics. Acreages of irrigated pulse crops could change significantly year-to-year based on the profit potential of competing crops.

In 2011, approximately 6,200 acres of irrigated pulse crops (excluding dry beans) were grown in Montana, with the Golden Triangle accounting for 30.4%, Southwestern Montana accounting for 34.4%, and Northeastern Montana accounting for 10.8%. In 2010, there were approximately 12,000 acres of irrigated pulse crops (excluding dry beans), with the Golden Triangle accounting for 56.5%, Southwestern Montana accounting for 18.2%, and Northeastern Montana accounting for 13.4%.

Illustration of Potential Irrigated Pulse Crop Production in Montana (*excluding dry beans*)

Region	Good Quality Irrigated Cropland (Acres)	Irrigated Acres Producing Non-forage Crops (Acres)	Estimate of Acres that Might be Switched to Pulse Production (Acres) / % of Irrigated Acres Producing Non-forage Crops
Golden Triangle	237,300	153,500	12,740 / 8.30%
Southwest	213,300	87,600	6,670 / 7.61%
Upper Yellowstone	203,400	111,000	6,390 / 5.76%
Northeast	139,700	81,100	5,270 / 6.50%
West	94,800	31,300	2,360 / 7.53%
Blaine/Phillips	70,500	16,700	1,330 / 7.95%
Other Counties	149,300	31,400	2,300 / 7.35%
Total	1,108,300	512,600	37,060 / 7.23%

Golden Triangle Counties: Cascade, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, Toole

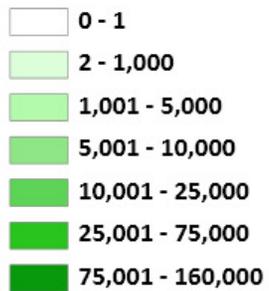
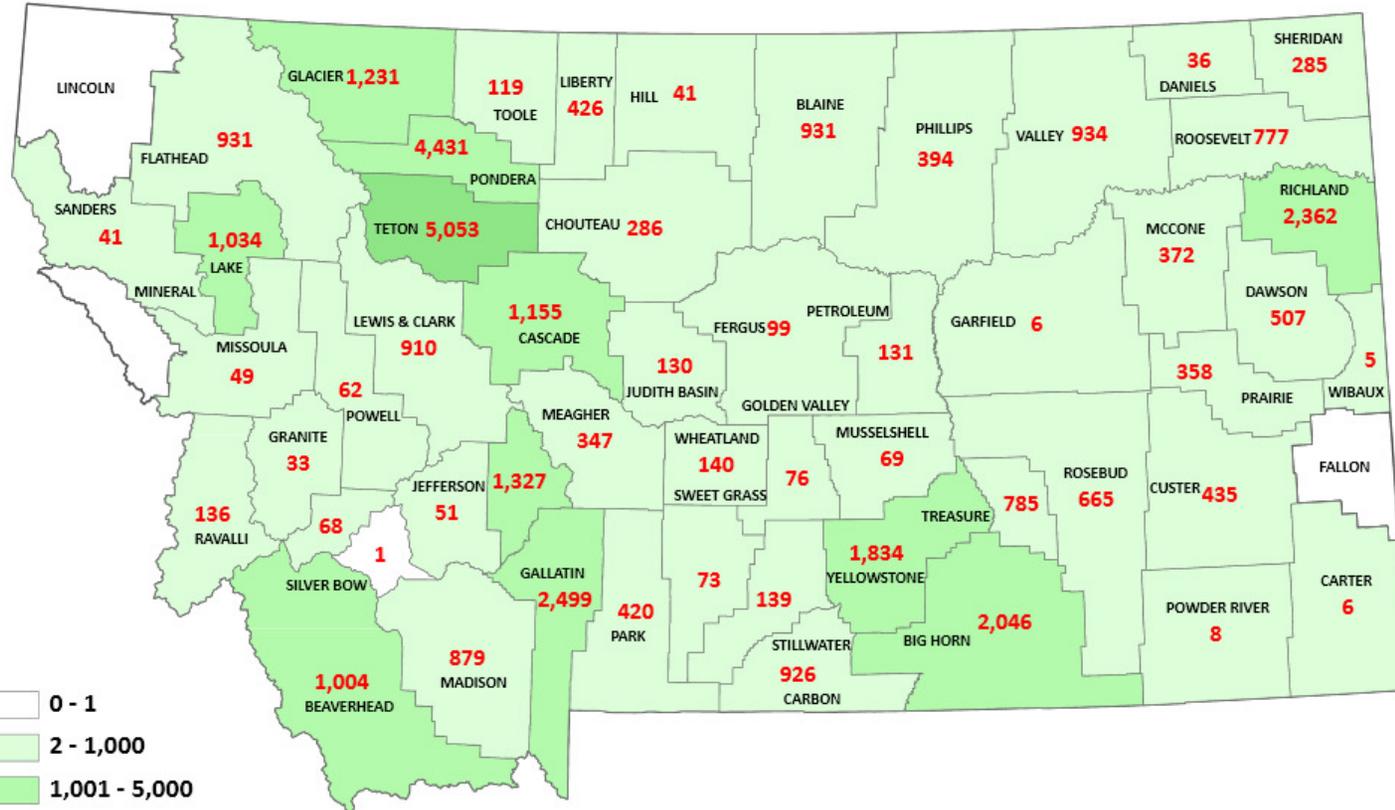
Southwestern Counties: Beaverhead, Broadwater, Gallatin, Jefferson, Lewis & Clark, Madison

Upper Yellowstone Counties: Bighorn, Carbon, Rosebud, Stillwater, Treasure, Yellowstone

Northeastern Montana Counties: Daniels, Dawson, McCone, Richland, Roosevelt, Sheridan, Valley

Western Montana Counties: Deer Lodge, Flathead, Granite, Lake, Lincoln, Mineral, Missoula, Powell, Ravalli, Sanders, Silver Bow

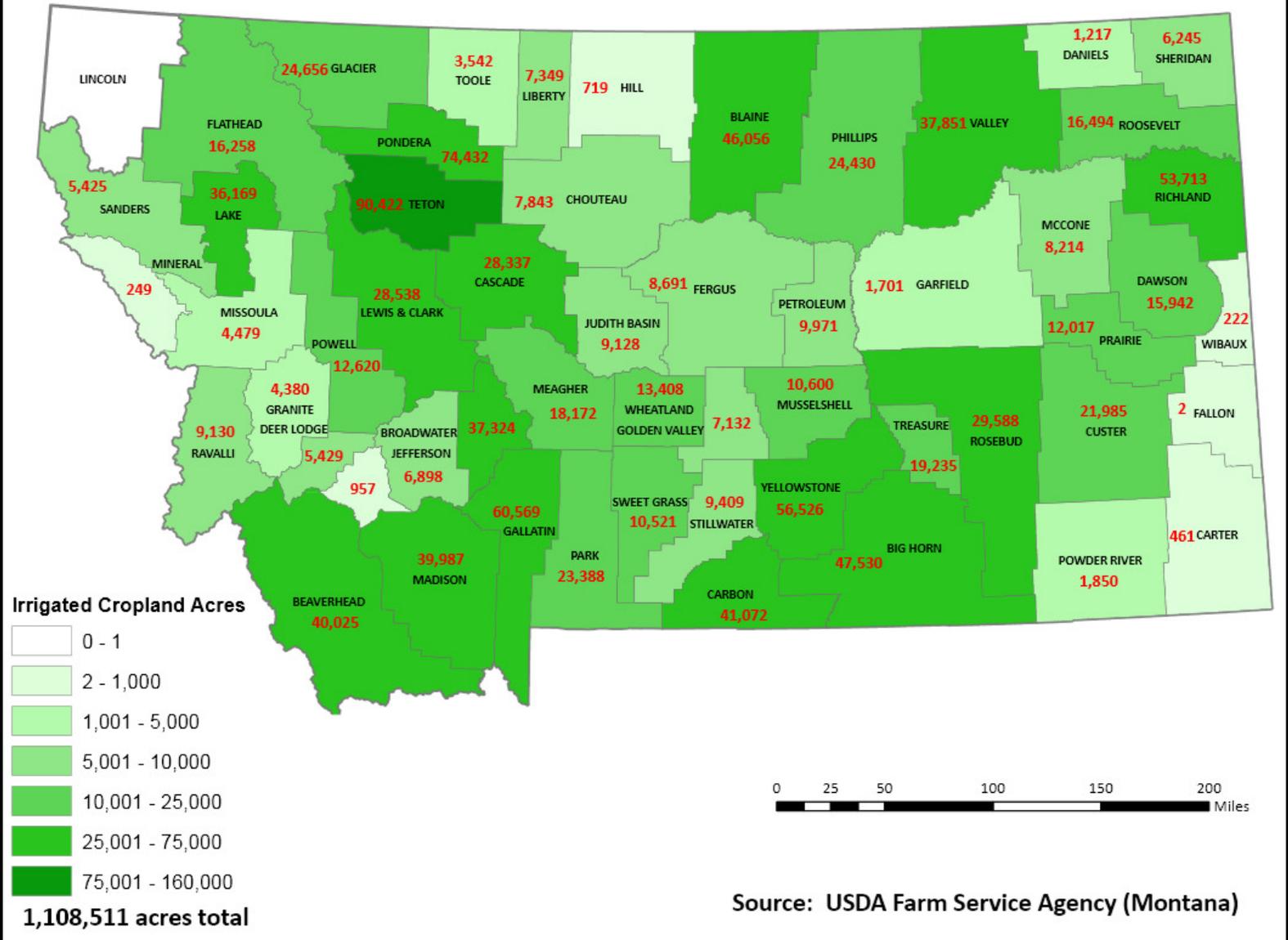
Illustrated Potential Irrigated Pulse Crop Acreage (5 - 15 Years)



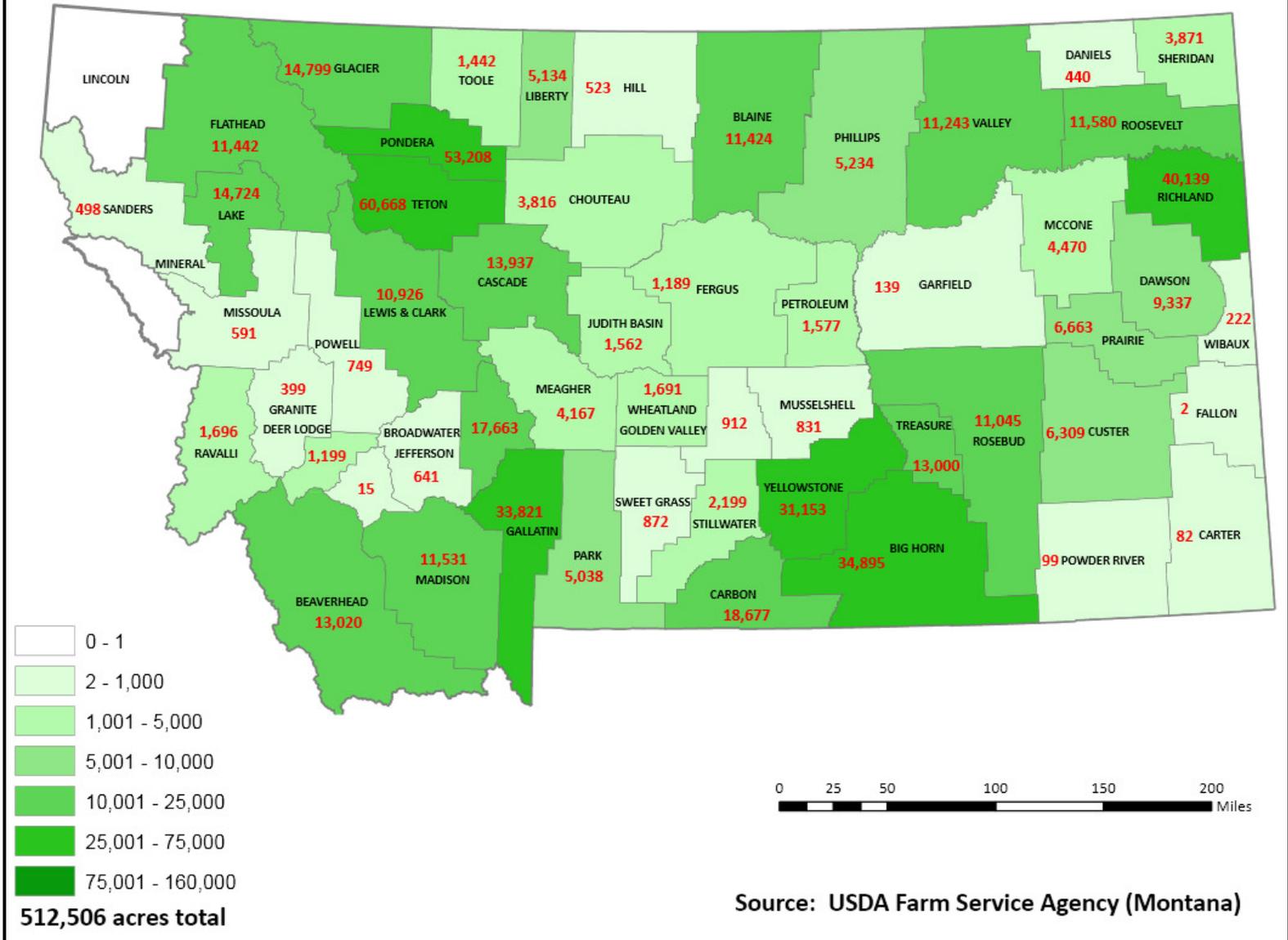
37,067 acres Total



Irrigated Cropland Acreage (2007 - 2010 Average)



Irrigated Cropland in Non-Forage Crops (2007 - 2010 Average)



6.0 POTENTIAL ECONOMIC BENEFITS OF INCREASED IRRIGATED PULSE ACREAGE

The magnitude of economic benefits that may result from increased irrigated pulse acreage is smaller than what might occur in dryland cropping systems. Montana has far fewer irrigated cropland acres than dry cropland. Also, the potential economic gain that may be achieved by increasing irrigated pulse crop production is incremental in nature because irrigated cropland normally is continuously cropped with no fallow acreage to replace.

Irrigated cropland tends to be geographically concentrated. So, while the potential economic benefits may be modest on a state-wide scale, economic benefits will be focused on certain communities. The regions most likely to benefit from expanded irrigated pulse acreage include the western Golden Triangle Region (between Great Falls and Cut Bank), southwestern Montana, the Yellowstone River Valley, the Milk River Valley, and the Lower Missouri River Valley. Of these, the areas most likely to see substantial increases in irrigated pulse production are the western Golden Triangle and southwestern Montana, where the potential for increased irrigated pulse acreage is the highest due to the climatic conditions and economics of competing crops.

It is difficult to estimate the economic benefit of increased irrigated pulse production for several reasons. Compared to dryland pulse production, there is less information and experience to draw from in estimating profitability and economic benefits. The regions with irrigated cropland vary significantly from each other, and as a result, the potential economic benefits vary with location. Additionally, some of the potential economic benefits may not occur every year and may be location-specific. For example, economic benefits from reduced irrigation water usage might be limited to specific irrigation districts and may occur infrequently.

Because of the difficulty in estimating the economic benefit of increased irrigated pulse production, the author advises readers to view the estimates made in this section cautiously and warns against adding all the potential economic benefits together to calculate a total estimated economic benefit. However, this caution is not meant to take away from the message that significant economic benefits (*possibly in excess of \$5 million, annually*) might be realized from increased irrigated pulse production on a modest amount of acreage.

Economic benefits might be realized in the following ways:

- rotational benefits benefiting cereal crops that follow pulse crops;
- incrementally higher returns that might be achieved by some pulse crops (relative to other crops grown);
- potential reduction in irrigation water requirements (particularly in dry years);
- potential increases in prices attributed to increased competition between buyers of crops grown under irrigation; and
- potential increases in agricultural processing that may be brought about because of increased irrigated pulse production.

6.1 ROTATION BENEFITS – FOR ILLUSTRATED INCREASE IN IRRIGATED PULSE ACRES

For the illustrated potential acreage of irrigated pulse crops (described in Section 5), the economic benefit of irrigated pulse crops to the following wheat and barley crop is estimated to be \$2.8 million. Relative to dryland cropping systems, the economic benefit of rotating pulse crops into cereal grain production may be even greater on a dollar-per-acre basis (\$50 - \$103/acre). The rotational benefits of irrigated pulse production may improve yield and crop quality, help break disease cycles, and potentially benefit weed control through use of different herbicides and altering weeds' habitat.

Estimated Economic Benefit of Irrigated Pulse Crops to the Following Wheat and Barley Crop

	Acres of Following Crop Benefited by Pulse Production	Economic Benefit from Yield Improvement	Economic Benefit from Increased Protein Content	Total Economic Benefit
Spring Wheat	18,530	\$1,260,040	\$652,256	\$1,912,296 / \$103.20/acre
Barley	18,530	\$926,500	\$0	\$926,500 / \$50.00/acre
Total	37,060	\$2,186,540	\$652,256	\$2,838,796 / \$76.60/acre

6.2 ECONOMIC BENEFIT RESULTING FROM PULSE CROPS GENERATING INCREMENTALLY HIGHER RETURNS (THAN CROPS BEING REPLACED)

For the illustrated potential acreage of irrigated pulse crops, the improvement in farm profits resulting from irrigated pulse crops generating incrementally higher returns is estimated to be roughly \$1.2 million.

Assumptions:

- 1/3 of the irrigated pulse acres (12,353 acres) are \$100/acre more profitable than the crop(s) being compared and
- 2/3 of the irrigated pulse acreage (24,707 acres) is equally profitable to the crop(s) being compared.

For farmers to plant irrigated pulse crops, the profit potential of irrigated pulse crops will need to equal or exceed crops currently being planted (*even though separate economic benefits may be realized as a result of crop rotation*). In economic models developed by the Montana Department of Agriculture (*which can be downloaded from <http://www.agr.mt.gov/business/cropandrotationtools.asp>*), irrigated pulse crops appear to be economically competitive in many situations. However, with the volatility of commodity prices and costs of production in recent years, it is difficult to make economic comparisons of crops with reasonable accuracy and timeliness.

In some cases it would be appropriate to compare pulse crops to the most profitable crop alternative. In other cases, the profitability of pulse crops would be compared to certain crops that serve a particular role within a crop rotation. Such a crop may be planted by farmers even though it may not have the highest profitability. The risk tolerance of the individual farmer (and financial ability / capacity of the farm to take risk) plays an important role in determining which pulse crops the farmer considers. Additionally, historic weather patterns and each field’s soil type and type of irrigation system may dictate if pulse crops should be considered and which pulse crops are considered. Because of the volatility of commodity markets and costs of production, pulse crop profitability may not always offer a favorable alternative to the crops they might replace.

Compared to peas, chickpeas and lentils offer higher profit potential. However, irrigated chickpeas and lentils likely have higher levels of risk and variability. Less information is available to farmers for growing irrigated chickpeas and lentils, and farmers have less collective experience in growing chickpeas and lentils under irrigation. If Montana farmers establish a record of consistent successful production of irrigated chickpeas and lentils, the percentage of the irrigated cropland planted in higher value pulse crops will likely increase.

Some pulse buyers have expressed interest in seeing increased irrigated chickpea production. If grown successfully, irrigated chickpeas would generate high returns, similar in profitability to dry beans. In comparison to dry beans, chickpeas do not have federal farm program base acreage restrictions. Irrigated chickpea production is not common in Montana, but it has been done successfully in some other locations (and at least twice in Montana).

6.3 REDUCTION IN IRRIGATION WATER REQUIREMENTS

Pulse crops are efficient when it comes to water consumption. Irrigated pulse production on 37,060 acres could reduce statewide irrigation water consumption by roughly 18,530 acre feet, if the pulse production replaced small grains. If the pulse production replaced alfalfa, irrigation water consumption might be reduced by 37,060 acre feet.

During a growing season, irrigation water is often applied on crops at the following rates:

- Alfalfa: 15 – 24 inches
- Small Grains (wheat/barley): 12 – 15 inches
- Pulse Crops: 6 – 12 inches

It is difficult to place an economic value on the potential water savings because Montana does not have active water markets. The value would vary depending on the year (stream flow shortage vs. surplus), the time of the year, and the party interested in using the water (other irrigators, municipalities, industrial users, and parties valuing water for its in-stream environmental services). A study conducted for the Montana Department of Natural Resources and Conservation in 2008 indicates that Montana farmers may value irrigation water at a rate of over \$40/acre foot, while the value to municipal water users may exceed \$100/acre foot. This indicates the potential annual value of water savings achieved by growing irrigated pulse crops instead of small grains might range from \$740,000 to over \$1.85 million. The potential annual value of water savings achieved by growing irrigated pulse crops instead of alfalfa might range from \$1.85 million to over \$3.7 million.

Farmers in some locations raise irrigated alfalfa for rotation purposes. A switch from irrigated alfalfa to a crop rotation that utilizes pulse crops for rotation benefits should decrease total irrigation water consumption when crops are grown that have low to moderate moisture requirements. Crops such as potatoes and sugar beets may have water requirements similar to or greater than alfalfa.

Until water markets are developed, the only situation in which water savings could be monetized might occur during drought years in which insufficient water is available to irrigate all the cropland that is deemed to be irrigable. During these dry years, irrigated pulse crops could play a role in extending irrigation water supplies. Pulse crops may enable farmers to irrigate more acreage in dry years, reducing the amount of irrigated acreage abandoned to dryland production or left fallow. In such a situation, the economic benefit of raising irrigated pulse crops could be relatively high to farmers.

Surface water originating from mountain snowmelt is the source of water for irrigated cropland in the Golden Triangle and southwestern Montana, as well as most of Montana. The drainages in the Golden Triangle and southwestern Montana are essentially fully appropriated, with irrigated agriculture accounting for the majority of the consumptive use. In the past 15 years, critical water shortages occurred (particularly in the Valier/Conrad area) that impacted water available for irrigation and generated conflict with non-agricultural water users. Over the long term, water conservation will become increasingly important for irrigated agriculture if climate change predictions prove to be correct that the northern Rocky Mountains will have smaller snowpacks and that snowmelt runoff will occur earlier.

Illustration of Economic Value of Increasing Irrigated Pulse Production in Drought Years

In water-constrained conditions (such that only 0.5 acre-feet of water per acre is available) a farmer managing a pivot irrigated field could decide between the following alternatives:

- plant peas and irrigate the entire field or
- plant and irrigate barley on half of the field and raise barley under dryland conditions on the other half of the field

Farm Level Profits Perspective

Using crop economics spreadsheets developed by the Montana Department of Agriculture to estimate relative crop profitability in 2011, the estimated return after direct costs for the field of irrigated peas would be \$372/acre, while the estimated return after direct costs for the barley field (*of which only half the field is irrigated*) would be \$200/acre. In this case, the advantage of planting peas would be \$172/acre.

The difference could vary in future years. Analysis of irrigated crop production economics for recent years indicates that the profitability of irrigated barley and irrigated peas has been fairly similar to each other in the past. Even if irrigated peas were less profitable than irrigated barley, most likely raising irrigated peas on the entire field would be more profitable than raising irrigated barley on half the field and dryland barley on half the field. The return after direct costs of dryland barley is likely to be considerably less than either irrigated barley or irrigated peas.

Regional Economic Perspective

If a region impacted by an irrigation water shortage was large enough that 20,000 acres of irrigated peas were planted in response to conditions, the estimated economic benefit of utilizing peas as a means to cope with the irrigation water shortage would be \$4.25 million or \$212.50/acre of irrigated cropland planted in peas.

6.4 INCREASE IN AGRICULTURAL PROCESSING: VALUE ADDED, EMPLOYMENT, CAPITAL INVESTMENT

Some pulse buyers/processors considering investment in handling and processing facilities in Montana may look at the potential of irrigated pulse production to help ensure dependable supply and consistent quality characteristics. Such facilities would also purchase dryland pulse crops. In this way, irrigated production might play a key role in attracting expanded pulse processing that benefits dryland production.

One example of irrigated crop production in Montana influencing the construction of a processing facility is the malting plant in Great Falls. The malting plant buys substantial volumes of dryland malting barley, but unquestionably would not have been built were it not for the consistent, large, high-quality irrigated malting barley crop grown in Teton, Pondera, Cascade, Glacier, and northern Lewis & Clark counties.

Expanded agricultural processing is beneficial to both producers and affected communities. For farmers, processing facilities create strong markets. Processors have a natural incentive to aggressively pursue commodity supplies to keep their plants fully utilized. In theory, this should result in farmers receiving higher prices than they would otherwise. The impact of processing impacting local prices has been demonstrated in the Corn Belt in the mid-2000's, when ethanol plants boosted nearby corn prices approximately \$0.05 - \$0.10/bushel (Dave Swenson, "*Input-Outrageous: The Economic Impacts of Modern Biofuels Production*", June 2006, Iowa State University Department of Economics). In theory, as long as the margins are profitable, processing facilities should optimize net income by maximizing throughput. For communities, processing facilities create jobs, generate tax revenues, and increase economic activity to benefit many local businesses.

Expanded irrigated pulse production could potentially influence the construction of pulse processing facilities. The magnitude and types of economic impacts that might result from a pulse processing facility are discussed in Section 7. If dryland farmers in the Golden Triangle are particularly cautious about adapting pulse crops into their rotations, a pulse processing facility (that relies on irrigated production) may help generate higher levels of local market demand and industry visibility that positively influences dryland pulse crop production.

6.5 INCREASED COMPETITION – POTENTIAL FOR LOCALIZED INCREASE IN COMMODITY PRICES

The developing pulse industry is attracting new commodity buyers to Montana that will compete for acres of supply. As a result, the developing pulse industry is helping to reinvigorate competition between buyers and crops.

There are several reasons why competition might be more likely to impact prices on crops grown on irrigated cropland (*as compared to dryland crops*). Some buyers (particularly malting barley buyers) specifically want crops produced from irrigated cropland, and there are only a few regions in North America that grow high quality malting barley. The Golden Triangle, which is Montana’s center of irrigated malting barley production, is also the area most likely to have the largest acreage of irrigated pulse crops. In Montana, certain crops (such as sugar beets, potatoes, dry beans, and dairy-quality alfalfa) can only be grown under irrigation. Seed production often occurs on irrigated cropland because of the dependability and consistency of yields and quality. Nationally, the quantity of irrigated cropland is relatively limited, and there are factors that are reducing the amount of irrigated cropland, including competition for water resources, dwindling groundwater supplies, and conversion of irrigated cropland to nonagricultural uses.

If it can be presumed that additional competition (*resulting from increased irrigated pulse production*) raises irrigated barley prices by 0.5%, then the potential statewide increase in farm revenue could be approximately \$0.5 million.

Explanation:

- 200,000 acres (of irrigated barley) * \$500/acre revenue * 0.5% increase in price attributable to competition for irrigated cropland acres = \$0.5 million.

The net economic benefit to Montana might be less than the increase in farm revenue since the profits of commodity buyers might be reduced. However, the in-state economic multiplier effect of farm profits likely is greater than the in-state economic multiplier of commodity buyer profits.

7.0 ECONOMIC IMPACT OF PULSE PROCESSING & MERCHANDISING

It is difficult to develop estimates for the economic benefits attributable to pulse processing and merchandising in Montana because the information needed to assess the benefits is (not surprisingly) closely held by businesses, including the volume of pulses being processed and the degree of processing. Most likely, the majority of Montana-grown pulse crops are currently shipped out of the state unprocessed. It is clear that processing facilities provide incremental economic benefits because additional operating costs are incurred and value is added through processing.

7.1 PULSE PROCESSING

A recent increase in pulse processing in Montana and growing interest by pulse processors in Montana represent bright spots at a time when U.S. manufacturing continues to move overseas.

As of December 2011, there were three large processing facilities in Montana (located in Plentywood, Chinook, and Hingham) and a small processing facility in Ulm. The Chinook pulse processing facility began operations in 1997. At Plentywood, processing began in 1996. Significant additional investment was made in the Plentywood facility in the 2009 – 2010 time period. The Hingham processing facility began operations in 2010. All of these facilities were existing grain handling facilities that were modified for pulse processing. An expansion is planned at the Chinook processing facility, and a new facility is slated to be constructed west of Chester in the near future.

Pulse processing can include cleaning; cleaning and bagging; splitting; decorticating (taking the skin off of lentils); or milling pulses into flour. The facilities in Chinook, Plentywood, and Hingham perform cleaning and bagging. The facility in Hingham also decorticates and splits lentils and is one of three facilities in the U.S. capable of splitting lentils.

Several processing facilities outside of Montana process Montana-grown pulse crops. Two other facilities located outside of Montana (in Williston, ND and Spokane, WA) process significant volumes of Montana pulse crops. Four other processing facilities located in North Dakota (Ray, Minot, Garrison, and Bowman) directly purchase pulse crops from Montana growers. Additional Montana-grown pulses are processed at other facilities located in North Dakota, Idaho, Washington, and Saskatchewan.

7.2 ESTIMATES OF ECONOMIC IMPACTS OF PULSE PROCESSING FACILITIES

The following provides rough estimates of different types of economic impacts generated by pulse processing facilities. The estimates provided are not to be seen as reflective of any of the existing processing facilities in Montana, but rather a hypothetical processing facility. Because such information is not readily available, rough estimates with ranges were used. At the low end of the range, a facility might process approximately 23,000 – 35,000 acres of pulse crops. At the high end of the range, a facility might process approximately 50,000 – 75,000 acres of pulse crops.

- Capital investment: \$3 - \$15 million per processing facility
- Property tax revenue: \$45,000 – \$225,000 per year (if no property tax incentives are provided)
- Annual payroll: \$175,000 - \$700,000 (5 – 20 employees)
- Annual purchases of pulse crops for processing: \$7 million - \$15 million, depending on the type and volume of pulses purchased.
- Annual value added: \$1.75 million - \$10.5+ million, depending upon the type of processing being done, the mix of crops being processed, and the end market.

7.3 ESTIMATE OF VALUE ADDED THROUGH PULSE PROCESSING IN MONTANA FOR THE 2010 CROP

In 2010, Montana farmers harvested 4,140,000 cwt of peas (*cwt = hundred weight = 100 lbs*) and 3,359,000 cwt of lentils. Based on the assumptions described below, the value added to the 2010 Montana pea and lentil crop may have been approximately \$15 million. In the coming years, the value added to Montana pulses will increase as processing plants operate at higher levels of utilization and as the capacity of new or expanded plants comes on line. The value added by processing manifests itself in several ways: profits earned by the processor companies, wages, other operating costs, capital investment recovery, taxes, and shipping costs.

Assumptions for Estimating Value Added to 2010 Montana Pulse Crop

<p>Pea Cleaning <u>Assumptions</u>: estimated \$4.3 million value added</p> <ul style="list-style-type: none"> • 15% of Montana's the peas were cleaned in Montana (621,000 cwt) • \$6.88/cwt value added <p>Lentil Cleaning Assumptions: estimated \$10.1 million value added</p> <ul style="list-style-type: none"> • 40% of Montana's lentils were cleaned in Montana (1,343,600 cwt) • \$7.50/cwt value added <p>Lentil Decorticating/Splitting Assumptions: estimated \$1 million value added</p> <ul style="list-style-type: none"> • 3% of Montana's lentils were split in Montana (100,770 cwt) • \$10/cwt value added (combination of cleaning & splitting) <p>No estimate was made for the value added to lentils processed and packaged for retail sale, but at least one facility is involved in retail packaging at a commercial level.</p>
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Pulse Processing Value Added Matrix

	Grower Price \$/cwt	Dealer Price (Whole, Cleaned) \$/cwt / \$ Value Added (\$/cwt) / % Value Added	Dealer Price (Split) (\$/cwt) / Net Price per Whole Pea Processed*** / \$ Value Added (\$/cwt) to Cleaned Grain / % Value Added to Cleaned Grain
Green Peas*	\$11.00	\$17.75 / \$6.75 / 61.3%	\$22.25 / \$19.81 / \$2.06 / 11.6%
Yellow Peas*	\$9.50	\$16.50 / \$7.00 / 73.7%	\$21.50 / \$19.18 / \$2.68 / 16.2%
Richlea Lentils**	\$31.50	\$39.00 / \$7.50 / 23.8%	Prices Not Reported, possibly \$2.50/cwt value added by splitting cleaned lentils

* Based on 1/29/2011 USDA Prices for Washington/Idaho

** Based pm 1/29/2011 USDA Prices for Montana / North Dakota

***Assumes 15% loss during splitting, with byproduct being sold for \$6/cwt: (85%* Dealer Split Price + 15% * \$6/cwt)

7.3.1 Factors Influencing Additional Development of Pulse Processing Capacity

There are market forces both encouraging and discouraging additional development of pulse processing capacity in Montana.

Factors Encouraging Additional Development:

- Trend of expanding pulse acreage, with potential for significant growth. Put simply, as more acres of pulse crops are grown, more pulse processing facilities (and delivery points) are likely to be established. There is strong interest by pulse processors and merchandisers in expanding operations in Montana.
- Strict enforcement of India's import standards may force exporters to clean pulse crops prior to shipping to India. In recent years there has been inconsistent enforcement of those import standards (particularly regarding weed seed) that has allowed uncleaned pulses to be exported to India. Enforcement (albeit inconsistent) has created difficulties for large shipments of uncleaned pulses to India in the last year.

- Several years ago, India banned exports of pulse crops from India in response to a food supply crisis. This ban has yet to be lifted. The ban opened up markets for processed pulses from other countries and seems to be enticing some foreign investment in the U.S. and Canada by foreign entrepreneurs looking to help fill the gap.
- For some markets and companies, processing near the point of origin can improve the economics of pulse trading and allow for greater quality focus (see next bullet). Processing can reduce the total amount of mass that is shipped. Splitting or decorticating pulses results in as much as 15% of “waste” (byproduct that is marketed locally as animal feed or be milled into flours for the food ingredient market).
- It appears that some pulse market participants are seeking greater control over their supply chain for purposes of quality control, supply assurance, and cost control. Some of these participants perceive that owning and operating pulse processing facilities near the crop origin is a good strategy for meeting their objectives. Montana has a growing reputation as being an origination point for high quality peas and lentils. Quality is particularly important to the market participants involved with marketing branded products in countries with growing middle classes. Modest-sized, quality-focused market participants are more likely to benefit from processing near the crop origin than large market participants focused on throughput and cost efficiency.
- There is significant potential for large increases in domestic demand for pulse-derived manufactured functional ingredients used to enhance processed foods. Additional investment in milling facilities may be required to provide specialized capabilities and milling capacity.

Factors Discouraging Additional Development:

- An increase in pulse processing along busy rail routes of major rail lines is not in sync with major rail lines’ operational objectives. The majority of pulse production in Montana occurs near BNSF’s busy northern transcontinental rail line. Strong economic forces and operational goals drive BNSF’s desire to have as many shipments as possible be on dedicated 110 car unit trains, with regular scheduled service and fast turnaround times. Besides maximizing utilization of equipment and efficiency of operations, dedicated 110 car unit trains allow BNSF and other major railroads to maximize the throughput of their rail infrastructure and avoid rail capacity constraints. To-date, pulse processing facilities have not been shipping 110 car unit car trains of processed pulses. However, at least one company has made unit car train shipments of raw unprocessed peas. Local rail services that deliver and retrieve individual cars potentially cause interruptions with the flow of trains across busy routes. BNSF anticipates its major lines to become even busier.
- Fuel costs (which could increase dramatically in the future) discourage development of pulse processing facilities that might utilize long-haul trucking to counter discouraging factors related to rail freight.
- The absence of intermodal shipping hubs in Montana that enable international containers to be loaded and shipped in a cost-effective and efficient manner may be a limiting factor to the expansion of the pulse processing industry in Montana. Access to competitively-priced international container shipping would encourage additional development of pulse processing facilities.
 - Containers are important for exports of processed pulses to preserve cleanliness, quality, and lot identity of processed pulses. Processed pulses are generally packaged in bags that need to be loaded into containers. Uncleaned pulses are often shipped by container because the volume being shipped is too small to be shipped in the hold of a bulk freighter.
 - The nearest intermodal facilities that handle containers are distant, and it is inefficient and expensive to truck containers from these intermodal hubs. It has been more cost-competitive to rail bagged processed pulses in boxcars to transloaders to be loaded into

containers or rail cleaned pulses in bulk to transloaders at ports to be loaded into containers.

- The biggest factor in enabling container shipping from Montana is drawing the interest of shipping lines (which own the containers). Once empty containers are loaded on trains to be shipped the West Coast from the Midwest, the shipping lines have not been interested in dropping off empty containers along the way to be filled. In order for the shipping lines to be interested (*and for container shipping from Montana to be cost-competitive*) there needs to be a sufficient volume of inbound freight (*loaded containers being delivered to Montana*). To date, sufficient inbound freight has yet to be identified. The key to the current success of an intermodal facility in Minot, North Dakota is inbound containers loaded with ceramic materials made in China that are used in oilfield fracking. To be considered by BNSF, the minimum requirement for establishing container transport service would likely be the commitment of an intermodal facility to make a weekly shipment of a 110 car unit train. Due largely to increasing pulse production and processing capacity, Montana’s potential outbound container shipment volume may reach “minimum required” volumes in the foreseeable future. Most likely, a single shipping point would aggregate containers loaded with pulses from multiple pulse processors and loaded with other products, such as identity-preserved cereal grains. However, the key constraint of identifying sufficient inbound container volume remains unresolved at this time.
- Montana’s two major pulse growing regions are not proximate to intermodal shipping hubs providing trailer service (truck trailer on train) for shipments to distant locations in the United States. This may potentially be a limiting factor to the expansion of the pulse processing industry in Montana. However in comparison to establishment of an international container handling facility, the hurdles to establishing this service may be lower.
- U.S. immigration policies have made it difficult for foreign investors to bring in skilled employees on a temporary basis. The foreign investors have communicated the need of such employees for the installation of specialized pulse processing equipment (lentil splitting equipment), the startup of such equipment, the operation of lentil splitting equipment, and the training of U.S. citizens to become master splitters. One pulse processing company is expressing reservations about continuing with its (*substantial*) capital investment plan because of the experience it has had. This company may choose to make those investments in Canada instead. Canada’s immigration policies are much more reasonable and welcoming in this regard. It is possible that more than one processing company pursuing business in Montana will be at risk of delays in the installation and startup of lentil splitting equipment because of United States’ immigration policies. Problems will be avoided only if these companies have been very deliberate (and lucky) in integrating their workforce planning elements into their equipment acquisition and installation. Another approach to bringing in necessary foreign workers is to use visas that allow for intercompany transfers; however, this remedy is not available for startup companies that may have foreign investors, but lack established foreign parent companies.
- Labor supply shortages in northeastern Montana, combined with high wage rates influenced by the oil boom in the Williston Basin are a major business risk to new pulse processing plants becoming established in northeastern Montana. These conditions have presented very difficult and frustrating conditions for the existing pulse processing facilities in the region. This situation is encouraging projects developers to look to other regions of Montana (such as the Golden Triangle and south central Montana). However, in these other locations, project developers are concerned about the adequacy of the supply of locally-grown pulse crops in the current and short-term time frame.

7.4 PULSE MERCHANDISING

Unquestionably, value is added in the aggregation of pulse inventories; otherwise grain merchandisers would not be in business. No estimate is made in this paper of the incremental economic benefits generated by grain handling facilities that handle pulse crops but do not process the crops in any manner. In terms of capital investment, investment has been made to some existing facilities related to pulse handling, but no new elevators have been built to handle pulses yet.

Pulse crop buyers in Montana are utilizing grain handling facilities that otherwise might be economically obsolete for shipping wheat (due to economic efficiencies of new 110 railcar shuttle elevator facilities). Pulse crop delivery points encourage farmers to grow pulse crops. Delivery points also help pulse growers reduce shipping costs, since they otherwise would have to haul farther distances by truck. In the cases where grain handling facilities would otherwise be shuttered, merchandising clearly provides economic benefits of employment and economic activity that can be attributed to the developing pulse industry.

Roughly two dozen facilities in Montana are delivery points for approximately ten buyers. A number of companies are exploring the establishment of additional pulse delivery points with rail access in Montana. New construction will be considered by some of these companies. Expansion may occur in a staged manner, with very basic storage and rail loading facilities eventually expanding to large handling and processing facilities. The increased volume of Montana commodity shipments resulting from replacement of fallow by pulse crops has increased the economic activity in the transportation sector (trucking and rail) as well.

8.0 MARKET DYNAMICS – WHY THE PULSE MARKET WILL CONTINUE TO EXPAND

There are a number of demand and supply factors driving expansion of the pulse industry in the United States.

8.1 WORLD POPULATION AND ECONOMIC GROWTH

Population growth and economic gains in India, China, and developing countries are driving global demand. Unless India's economy stagnates or tumbles, demand will continue to increase from India. To meet dietary recommendations, India's consumption of pulse crops should be 22 million metric tons. India's normal production of a wide variety of pulse crops is 16 million metric tons, and it normally imports 3 million metric tons (*March 2010 Saskatchewan Pulse Growers Association Market Report, Martin Chidwick, Bissma Pacific, Inc.*). The gap between recommended consumption vs. production has increased every decade in the last 30 years. In the last 10 years, the gap has averaged 5.3 million metric tons per year (*March 2010 Saskatchewan Pulse Growers Association Market Report, Brian Clancey, STAT Publishing*). As India becomes more prosperous, demand for protein will increase to match or exceed dietary needs. For cultural/religious reasons, India's increased consumption of protein will largely come from pulse crops. Pulse crops will always be a low cost source of protein compared to meat. United States' exports are not limited to south Asian countries; the U.S. exports significant volumes to South America, Latin America, Europe, North Africa, the Middle East, and China. China has started importing large quantities of yellow peas from the U.S. and Canada. A major use of yellow peas in China is vermicelli noodle production. Interestingly, vermicelli noodle makers have valued yellow peas more for their starch than protein, but Chinese food manufacturers are starting to make broader use of yellow peas. In the August 2010 Saskatchewan Pulse Growers Pulse Market Report, Brian Clancey reports that *"China's food industry has been finding more uses for pea starch and bran. These new developments have seen [Canadian] sales increase from approximately 250,000 MT a season to more than 435,000 during the 2010/11 marketing year."*

8.2 PRODUCT SUBSTITUTION

Product substitution is another factor in increased demand for the pulse crops. Peas and lentils can serve as less expensive substitutes for other pulses and beans grown in south Asia. Globally, dry peas are the low-cost pulse crop. In recent years, when India faced food supply shortages and high prices, yellow peas were substituted for chickpeas; decorticated green lentils were substituted for pigeon peas; and green peas were substituted for mung beans. When the price of mung beans spiked, China started importing large quantities of yellow peas to substitute for mung beans in the production of vermicelli noodles.

8.3 WEATHER

Weather patterns and major weather events have worked to tighten global inventories. Poor growing conditions in recent years impacted pulse production in major growing regions like India, Turkey, and Australia. In 2010, the Ukraine and Russia were impacted by severe drought. In 2011, France (a major pea producer) was impacted by severe drought. In recent years, flooding in Pakistan and Bangladesh likely increased the need for imports into those countries. It seems as though challenging growing conditions that reduce supply are the norm, the location just changes. This has encouraged the pulse industry and major importing countries to look for new sources of supply. The United States, Montana in particular, is one of those new sources of supply. Large increases in production of pulse crops in the United States and Canada have helped sustain global supplies. Since much of the increase in production in North America has occurred on land that previously was left fallow, the growth in pulse supply has not come at the expense of other food commodities. Multiple cycles of supply volatility within a short period of time have caused foreign governments to be fearful about food shortages causing domestic

unrest in some countries. A result is that since 2008, India has prohibited pulse exports. A ripple effect has been the opening of markets previously served by Indian exports.

8.4 GLOBALIZATION

The forces of globalization, modernization, and trade liberalization are creating more opportunity for pulse exports from the United States. Besides expanding global trade of pulses, globalization is working to drive land use changes in traditional pulse production regions, where some pulse acreage is being lost to other crops and nonagricultural uses. An example of modernization impacting pulse acreage is the reduction of pulse acres in certain farming districts in Turkey, where the completion of irrigation projects led farmers to raise other crops in place of pulses.

8.5 DECLINE OF THE U.S. DOLLAR

The decline of the U.S. dollar has been very useful in making pulses grown in the U.S. more affordable and putting the U.S. exporters in a more competitive trading position. Both the Canadian and Australian dollars have appreciated relative to the U.S. dollar. Both are major pulse exporting countries, with Canada being the largest pulse exporter in the world by a large margin. While currency markets can be volatile, there appear to be fundamental forces at play that will keep the U.S. dollar weak for some time, although recent global economic volatility has caused the U.S. dollar to strengthen. Barring an unlikely collapse in oil, natural gas, and metal commodities demand, it seems unlikely that the Canadian and Australian dollars will weaken significantly.

8.6 OPPORTUNITY IN DOMESTIC & DEVELOPED-WORLD MARKETS

There is significant opportunity in domestic and developed-world markets for utilization of pulse ingredients in processed foods and for increased incorporation of pulses in diets. Pulse crops are high in protein, high in fiber, have a low glycemic index, and contain significant amounts of micronutrients. Pulses can be fractionated into components (protein, fiber, and starch) to yield highly functional ingredients in food processing. The proportion of world pulse production that is processed into protein, starch, and fiber fractions remains very small to date, but the potential markets for fractionated pulse ingredients are enormous.

8.6.1 Pulse Protein

Protein from pulse crops can be used to increase the protein content in processed foods and to make concentrated protein ingredients. Lentil flour is being incorporated into a nationally distributed, premium line of pasta. Compared to traditional pasta, this pasta is higher in protein and fiber, with a lower glycemic index, and has a full protein profile. The lentil flour gives the pasta some very favorable cooking attributes that make it firm and less likely to become waterlogged and soft when overcooked. It is anticipated that more pasta manufacturers will start incorporating pulse flours into their products. Pea protein ingredients have been successfully demonstrated to be a viable replacement for eggs in some food products. Certain fractionated pulse ingredients have advantages over other vegetable protein sources. Pea protein also is high in lysine, giving it an advantage over soy protein.

8.6.2 Pulse Fiber

Fiber from pulse crops can be used to increase the fiber content in processed foods. The use of pulse fiber is economical compared to fiber-fortifying gums or soy protein products. Pulse crops contain high amounts of both soluble and insoluble fiber. Soluble dietary fiber can reduce intestinal absorption of fat and cholesterol. Diets high in soluble fiber may reduce the risk of heart disease via favorable effects on blood pressure, blood glucose and insulin moderation, and reduced likelihood of obesity. Insoluble and soluble fiber are beneficial to the lower intestine in that they help eliminate harmful bacteria and promote good bacteria, plus promote regularity. Besides benefits to cardiovascular and digestive tract health, fiber helps prevent large swings in blood sugar levels.

Incorporating unprocessed pulses into diets can greatly increase fiber intake. Where a serving of most commonly consumed grains, fruits, and vegetables contain 1 – 3 grams of dietary fiber, a serving of one-half cup of cooked split peas provides 10 grams of dietary fiber, 40% of the daily recommended 25 grams (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pg. 25).

8.6.3 Pulse Starch

The properties of the starch in pulse crops cause whole pulses and ingredients derived from pulses to have a low glycemic index. Having a low glycemic index means that the carbohydrates in pulses digest slower. This helps with the regulation of blood sugar, which is good for people suffering from diabetes or at risk of diabetes and also helps extend periods of satiation. One in four Americans are insulin resistant and at risk of developing type 2 diabetes (*“Pulses the Heart of Healthy Food”*, a brochure produced by the Northern Pulse Growers Association and USA Dry Pea & Lentil Council). Pulse starch ingredients can enable food manufacturers to reduce carbohydrates. For example, gels made from pulse starch can be prepared with 50% less starch than corn starch (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pg. 101).

Starch made from pulse crops, particularly peas have functional properties that can make them useful for manufacturing processed foods. Pulse starches can be used to modify food texture, which is important for both processing and consumer acceptance. Pulse starch properties include good stability at high temperatures, high viscosity compared to cereal and tuber starches, excellent gel strength and bland taste (pea starch isolates), and ability to contribute to increased volume and expansion in extruded products and puffed snacks. These properties can enable food manufacturers to reduce fat in products and mimic the mouth-feel of fats. (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pgs.99- 103)

Starch from peas has been used in deep frozen dishes, dressings, extruded bakery products, cookies, crackers, sauces, instant soups, and puddings, but the volume of pea starch used in food manufacturing is not yet large (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pg. 100). The potential for growth in pulse starch utilization is significant, considering that current manufacture of pulse starch makes up only a small amount of the 6 million tons/year of starch produced in the United States (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pg. 25).

8.6.4 Pulse Nutrients

Pulse crops are good sources of important minerals like iron, magnesium, phosphorous, and manganese. They also contain significant amounts of phosphorous and the B vitamins (including folate). Lentils and chickpeas boast among the highest concentrations of folate. Adequate folate intake is important for fetal development. A single cup provides 37% of the recommended daily allowance (*“Processing Information & Technical Manual”*, USA Dry Pea & Lentil Council, pg. 27). Folate is necessary for the formation and development of new and normal tissue, helps break down an amino acid associated with heart disease, improves metabolism functions, and may reduce asthma and allergy suffering.

8.6.5 Nonallergenic Qualities

Pulse protein concentrates can be used to replace eggs as food ingredients in some applications. Eggs are the fourth most common food to trigger allergic reactions in adults in the United States, affecting over 30 million consumers (*“Pea Protein – Eggs Optional”*, a brochure produced by the Northern Pulse Growers Association and USA Dry Pea & Lentil Council, pgs. 1-2). Pulses are also gluten free. The development of functional pulse ingredient products could be very useful to the \$7 billion gluten-free industry which serves the celiac/gluten intolerant population (*“Pea Protein – Eggs Optional”*, a brochure produced by the Northern Pulse Growers Association and USA Dry Pea & Lentil Council, pg. 8). In the

United States, one of every 133 people are gluten intolerant (*"Processing Information & Technical Manual"*, USA Dry Pea & Lentil Council, pg. 109). Pulse ingredients may become important ingredients for baby food manufactured for infants with lactose intolerance and allergies to soy products (*"Processing Information & Technical Manual"*, USA Dry Pea & Lentil Council, pg. 116).

8.6.6 Pulse Product Development

Northern Pulse Growers Association, USA Dry Pea & Lentil Council, Northern Crops Institute, universities in Canada and the U.S., and other organizations have conducted some excellent research on pulse nutrition and health benefits, as well as innovative pulse product development. The progress made has been achieved with relatively modest investments. Continued research and product development will be a major driver in increasing pulse utilization in the United States and developed-world countries.

Although there is no information indicating that the potential product described in this paragraph is under development, the following provides an example of a high-value product that could potentially utilize pulse ingredients. A Wall Street Journal article (*"Feeding May Help Brain Injuries"*, April 21, 2011) stated that brain injury trauma is lessened when the victims receive at least 50% of their typical caloric intake in the first 24 hours after the injury. During the first 24 hours, the dietary intake needs to be high in protein and avoid extremes in blood sugar levels. Such a diet helps reduce inflammation and swelling of the brain and provides energy to help the brain heal. The properties of pulse ingredients (high protein and low glycemic index) would seem to address some of the requirements of this medical treatment. The market for such a product is significant. Annual cases of reported traumatic brain injury in the U.S. military exceeded 30,000 in 2010. According to the Brain Trauma Foundation, about 1.5 million patients report to emergency rooms each year with head injuries and as many as 3.8 million people suffer head injuries annually playing sports.

8.7 SUSTAINABILITY

The concept of sustainability is becoming increasingly important in terms of societal values, marketing, quality of life, and economic performance. Products made from pulse crops will have added market appeal because they are economically, environmentally, and socially sustainable. Efforts to advance the U.S. pulse industry and further develop the industry in Montana will have lasting benefit because pulse crops and the pulse industry address all of these facets of sustainability.

8.7.1 Economic Sustainability

Consumers' economic sustainability can benefit from increased pulse crop consumption. Previous paragraphs discussed potential health benefits that may occur from increasing pulse consumption and utilization of pulse crop ingredients in processed foods. As medical costs continue to escalate, consumers will increasingly turn to nutrition as a form of preventative medicine. In theory, a substantial increase in pulse consumption in the United States could translate into lower health care costs. The economic benefit to consumers would be compounded because pulses are inexpensive and protein from pulses costs considerably less than meat.

Increased pulse crop cultivation can improve the economic sustainability of farms. Earlier sections of this paper demonstrate how inclusion of pulse crops in crop rotations in Montana can improve economic sustainability of farm operations. High value pulse crops, such as lentils and chickpeas, in recent years have often been more profitable than other dryland crops in Montana. Diversifying crop rotations to include pulse crops may also reduce costs and damage caused by weed, crop disease, and insect problems.

With the likely prospect of large increases in energy costs and the possibility of future taxes on fossil fuels or carbon trading regimes, pulse crops will likely play an increasingly important role in the

economic sustainability of Montana farms, as it pertains to energy. A recent report written by Mac Burgess (Montana State University Ph.D. candidate) titled “*Telling the Energy Story of Pulse Crops*” shows pulse crops having a 53% lower energy input than cereal crops. In this study, the net energy productivity of pulse crops exceeded cereal crops. A major reason for this is that nitrogen fertilizer derived from natural gas is not used in the production of pulse crops. Interestingly, the rotational effect (*of pulse crops increasing the yield of the following cereal crop*) resulted in a net energy productivity that actually exceeded pulse crops’ energy advantage attributable to reduced nitrogen fertilizer use.

Utilization of pulse crops and pulse ingredients by food manufacturers may allow food manufacturers to offer premium products that generate better profit margins, thereby improving the food manufacturers’ economic sustainability.

8.7.2 Environmental Sustainability

Beyond economic impact to U.S. communities, farm operations, and food manufacturers, pulse crops provide other benefits to society. These benefits include better nutrition from foods derived from crops that use less natural resources, and conservation of cropland through improved soil health. Less fossil energy is used to produce pulse crops. Pulse crops use water efficiently, which can enable more intensive crop rotations in dryland farming systems or reduce water consumption in irrigated farming systems. Pulse crops can be incorporated into crop rotations to increase organic matter, improve soil health, and reduce erosion. Increased organic matter helps soil retain water and be less susceptible to leaching of nutrients, thereby making the entire cropping system more resilient. From a marketing perspective, pulse protein is “green” because the nitrogen that pulse crops synthesize into protein comes from the atmosphere, not from synthetic fertilizers made from nonrenewable natural gas. Additionally, nitrogen fixed by pulse crops helps reduce the amount of synthetic nitrogen needed to grow the cereal crops that follow pulse crops.

8.7.3 Social Sustainability

Pulse crops contribute toward social sustainability through:

- improved health;
- expanding agricultural production to meet the world’s increasing food demand (*through rotational benefits and replacement of fallow with crops*);
- enhancing rural economies;
- helping family farms remain economically viable through improved profits; and
- creating new employment opportunities in the United States.

9.0 WHAT MIGHT HELP MONTANA REALIZE ITS PULSE POTENTIAL?

Clearly, Montana's economy, farmers, and communities have a lot to gain from expanded pulse production. **There may be no single opportunity available to Montana's agricultural industry that offers as much potential benefit in the near term.** Many factors will influence whether and how fast Montana farmers increase pulse acreage. The largest factors, weather and commodity markets, are beyond the control of Montana's agriculture industry, universities, governments, and communities. But, there are a variety of actions to be considered, prioritized, and pursued by Montana stakeholders and policy makers that could assist Montana's pulse industry reach its potential and shorten the timeframe for the realization of economic benefits. Many of these actions are already being taken, but it may be worthwhile to evaluate the amount of resources being allocated and priority given.

In the short-term, efforts that support farmers in the process of replacing fallow with pulse crops and assist inexperienced farmers to start growing pulse crops successfully are likely to have the greatest economic impact in Montana. These efforts are most likely to be of the following nature: information support, widespread crop and rotation demonstration plots, variety trials, and production research.

Stewardship of Commodity Check-offs & Industry Organization Efforts

The Montana Pulse Crop Check-off helps fund pulse crop research, market promotion, and product development efforts carried out by the Northern Pulse Growers Association and the USA Dry Pea & Lentil Council. Their efforts seek to aid crop production and strengthen demand. If successful, these efforts should help yield profitable opportunities, solid prices, and diverse markets that support acreage expansion.

Check-off funds have been successfully used to advance the industry. Requests for refunds of check-offs should be discouraged. To this end, farmers should be kept informed of the value of their check-off contributions. The more Montana farmers that are actively engaged with check-off committees and industry organization representatives, the more broad-based the communication of farmers' needs and expectations will be to these organizations and to the agricultural research community. Similarly, farmers will be benefited by being attentive to and responsive to communications from specialists employed by these organizations pertaining to research findings, industry conditions, trends, and opportunities.

Pulse production can provide sizeable economic benefits to Montana's cereal grain industry. Pulse production can become integral to improved cereal grain cropping systems. Considering the magnitude of the potential benefits to be realized by cereal grain crops and the constraints on the developing pulse industry to sufficiently fund crop research, the Montana Wheat & Barley Committee should consider the making significant investments of wheat and barley check-off dollars into cropping system research (utilizing pulse crops within cereal grain rotations) and pulse variety development.

Escalation of Research Activity

The pulse industry is entering a growth stage from which disproportionate benefit may be realized from increased levels of research. There are many topic areas that need attention, of which the following is an abbreviated list:

- strategies and rotations for replacing fallow with pulse crops
- pulse breeding, particularly for winter varieties of peas and lentils, disease resistance, improved harvesting ease, traits benefiting consumers and processors
- widespread on-farm demonstration trials to build farmers' confidence and possibly aid in crop insurance policy development
- weed control

- irrigated production
- production economics analysis
- market research
- continued product development research and health benefits analysis to enhance utilization and expand processing

Improved Market Reporting

One factor that causes Montana farmers to hesitate to start growing pulse crops is inferior price and market information (*in comparison to what is available for cereal grain crops*). As the pulse industry grows in Montana, theoretically it should become possible to have more detailed price information available for different classes and grades of pulse crops. USDA Agriculture Marketing Service should be encouraged to expand its market reporting to provide more information, and the agriculture media should be encouraged to add pulse price reporting to farm reports.

Pulse crops are an excellent source of animal feed. The Alberta Pulse Growers Association publishes a bi-weekly report titled the “Feed Pea Benchmark”, which functions as a pricing reference. This report provides a consistent, unbiased estimate of the economic value of peas as a feed ingredient in three regions (central Alberta, central Saskatchewan, and southern Manitoba). The Feed Pea Benchmark Price is based on market prices of feed ingredients for which peas would be substituted in swine rations (barley, wheat, corn, corn distillers grains, canola meal, and soybean meal). The Feed Pea Benchmark helps animal feeders identify when peas offer an economic value and helps provide a tool for feed sellers and buyers to establish a fair price for feed grade peas. A similar market report applicable to Montana could be beneficial to animal feeders, farmers with off-quality peas, and farmers that are distant from traditional food-pea delivery points. A Montana report might expand upon the Alberta report by providing information applicable to both swine and feeder beef rations. Good market information and a strong market for off-quality pulse crops will help lessen farmers’ hesitation to expand production.

Establishing a Montana Identity in the International Market

Montana’s pulse industry could consider promoting Montana as a premier origination source for pulse crops at international trade shows. Montana’s pulse industry has benefited from promotion of the United States pulse industry, but benefit might be realized by establishing some additional market identity. Such differentiation could be subtle, but meaningful, and would not have to be at the expense of the larger U.S. pulse industry identity.

Addressing Challenges Related to Delivery Points & Shipping

As a state deep in the U.S. interior, transportation has always presented challenges for Montana industries. Some pulse merchants and processors expanding operations in Montana are struggling to find suitable and affordable locations and facilities. One of the complications is identifying locations that are compatible with the operations of Montana’s rail carriers, not only now, but in the future, when rail traffic is anticipated to increase substantially. Montana government officials and stakeholders may have a role in supporting the fair treatment of pulse shippers by railroads. Members of the pulse industry that need or desire identity-preserved shipping and do not anticipate being able to ship using 110 car unit trains may need to work cooperatively to address future constraints of rail traffic. Public – private partnerships in infrastructure development are something to be considered with regard to development of industrial parks providing rail access and capabilities for international container shipping and domestic truck-trailer-on-train shipments.

Encouraging Pulse Processing & Milling

Montana policy makers could consider actions that encourage or champion further development of pulse processing and milling in Montana. Besides increasing economic activity, creating jobs, and expanding the tax base, expanded pulse processing and milling would create stronger markets and more competition for Montana pulse crops. Pulse processing, such as decorticating, splitting, and milling can allow processors to utilize lesser quality pulse crops and add value to byproducts, providing stronger markets on the occasions that Montana's pulse crop has quality problems.

Montana's pulse industry is largely dependent upon foreign exports. Pulse milling and food manufacturing using pulse ingredients in Montana would help Montana's pulse industry diversify its market between foreign and domestic sales, which would strengthen Montana pulse markets and hedge Montana's exposure to changes in currency rates and volatility of global markets.

Engagement in Federal Policy Development

Federal government programs and policies impact the pulse industry and Montana's pursuit for expanded production. Some of the areas of potential impact include research (such as crop production, product development, economic analysis, health, and nutrition); multiperil crop insurance, USDA conservation programs, USDA subsidies, school nutrition, and free trade agreements.